BULLION MILL

(AKA: APACHE MILL, BULLION CREEK SUBDIVISION - LOT B)

PRELIMINARY ASSESSMENT REPORT

Blaine County
State of Idaho

Department of

Environmental Quality

December 2009

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

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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

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

December 30, 2009

Daniel Henry
308 North 2nd Avenue
Hailey, Idaho 83333

RE: Site Assessment of the Bullion (aka Apache) Millsite.

Dear Mr. Henry:

In 2006 the Idaho Department of Environmental Quality (IDEQ) and U.S. Environmental Protection Agency conducted site visits of mines in the Croy Creek Area (Croy Creek PA/SI 2008). Subsequently DEQ has completed a more in depth review of historical mining data and geological information at the above referenced mill site. Attached is the Preliminary Assessment regarding this site.

Based on the completeness of pathways between contaminated soils/tailings with recreational receptors, and potentially residential receptors, DEQ is making two recommendations to the owner; First is that the owner short circuits the pathways for exposure to recreational users at the site, and second that a reclamation plan is developed for the site to eliminate the erosion of tailings and soils at the site that have been destabilized by past activities. Relative to the first, DEQ suggests that there are a number of ways to short circuit the pathways including but not limited to posting the property, fencing the property, capping the tailings and contaminated soils in place, or removal and either reprocessing or disposal in a capped repository.

DEQ is also recommending that EPA run the site through the Hazard Ranking Score to determine if an additional Site Inspection is warranted. At this time DEQ suggests that the site is designated as an **Other Cleanup Action** as DEQ assumes that the owner will want to work voluntarily with DEQ to manage risks at the site.

DEQ also recommends that if this site is intended for residential development, further investigations and risk analysis should be conducted. Additional risk analysis based on this desired use will likely indicate that significant risk management will have to be incorporated in development and use plans.

IDEQ very much appreciates your cooperation and your approval for our access. I look forward to addressing any questions you may have regarding our findings. You may contact me at (208) 373-0554.

Sincerely,

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

BAS:TE:tg G:\Waste & Remediation\Bruce Schuld\Bullion-Apache Millsite

attachment

cc: Ken Marcy, Environmental Protection Agency
file

Table of Contents

List of Acronyms 6
Section 1. Introduction 7
Section 2. Ownership 8
Section 3. Overview 10
Section 4. Mine Site History 12
Section 5. Climate 13
Section 6. General Geology 14
6.1 Site Geology 15
Section 7. Current and Potential Future Land Uses 17
7.1 Current Land Uses 17
7.2 Future Land Use 17
Section 8. Site Conditions and Waste Characterization 18
Section 9. Soil & Sediment Sample Collection 24
9.1 Soil Analysis 26
9.2 Sediment Analysis 26
Section 10. Surface Water Sample Collection 29
10.1 Results 29
Section 11. Pathways and Environmental Hazards 31
11.1 Ground Water Pathways 31
11.2 Surface Water Pathways 35
11.3 Air Quality Pathways 35
11.4 Soil Exposure 35
11.5 Domestic Wells and Public Water Supplies 36
11.6 Residences, Schools and Day Care Facilities 36
11.7 Wetlands 36
11.8 Sensitive Species (Plant and Animal) 37
11.9 Fisheries 37
11.10 Sensitive Waterways 37
11.11 Livestock Receptors 37
Section 12. Summary and Conclusions 40
Section 13. References 41

List of Figures

Figure 1. Location of the Bullion Mill site with USFS parcel data overlay (Map source: Fair 100k, Sunv 100k, NAIP 2004). 9
Figure 2. Bullion Mill site and notable features (Map source: Fair 100k, Sunv 100k, NAIP 2004). 11
Figure 3. Geology of the Bullion Mill area (Map source: USGS 24k). 16
Figure 4. Bullion Mill site sketch map (IGS, 2005, p. 34). 20
Figure 5. Drawing of Bullion Mill sampling locations, tailings, and structures (from E&E, 2007). 25
Figure 6. Drinking water well locations and source water delineations (Map source: NAIP 2004). 34
Figure 7. Wetlands and 15-Mile TDL map (Source Fair 100k, Sunv 100k, NAIP 2004). 38
Figure 8. Sensitive species near the Bullion millsite (Source: Fair 100k, Sunv 100k, USGS 24K Topo). 39

List of Attachments

Attachment 1. Bullion Mill (IGS Number: HA-329M) Abandoned/Inactive Mine Land Inventory Field Checklist

List of Tables

Table 1: Total Recoverable Metals Analysis 27
Table 1: Total Recoverable Metals Analysis (continued)..... 28
Table 3: DEQ Water Samples Total Recoverable Metals Analysis (mg/L). 30

List of Acronyms

Acronym	Definition
amsl	above mean sea level
BLM	United States Department of the Interior, Bureau of Land Management
BMP	Best Management Practice
DEQ	Department of Environmental Quality
EPA	United States Environmental Protection Agency
E & E	Environment & Ecology, Inc.
gpm	gallons per minute
IDTL	Initial Default Target Levels
IGS	Idaho Geological Survey
MCL	Maximum Concentration Limit
PPE	Probable Point of Entry
HHSL	Human Health Medium-Specific Screening Levels
TCLP	Toxicity Characteristic Leaching Procedure
TDL	Target Distance Limit
TMDL	Total Maximum Daily Load
USFS	United States Department of Agriculture, Forest Service

Section 1. Introduction

This document presents the results of the preliminary assessment (PA) for the Bullion Mill site. The Department of Environmental Quality (DEQ) is 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 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. Priority was also given to mining districts where groups or clusters of sites could be assessed on a watershed basis.

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

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

Access to the Bullion Millsite aka Apache Mill was given by Daniel Henry in May of 2006.

Section 2. Ownership

DEQ does not warrant the ownership research or location of property boundaries contained in this report. The information regarding ownership and property boundaries was obtained from the Blaine County Tax Assessor's Office in Hailey, Idaho. The poor juxtaposition of the claims' boundaries that will be observed in this report's figures are plotted according to the Blaine County Tax Assessor's data base, and are indicative of probable errors that exist in the recorded surveys of the properties.

Within the following ownership descriptions the **"Partial Determination"** is meant to convey a very brief summary of DEQ's assessment of individual claims and parcels relative to human health and ecological risk factors associated with toxicological responses to mine wastes. A determination of No Remedial Action Planned or "**NRAP**" means that based on current conditions at the site DEQ did not find any significant evidence that would indicate the potential of adverse effects to human or ecological receptors on the parcel of land. This determination says nothing about risks associated with physical hazards such as open adits, open shafts, high walls, or unstable ground. "**Partial Determination"** of "**calculate HRS**" indicates that DEQ has determined that there is sufficient evidence to warrant calculation of a Hazard Ranking Score (HRS) by EPA's contractors. It also indicates that DEQ has made significant conclusions and recommendations that additional site assessment and/or remedial actions are necessary to prevent adverse affects to human or ecological receptors. These conclusions and recommendations are contained in the final section of this report.

Owner	Claim	Parcel Number	Partial Determination
Daniel Henry 308 North 2nd Street Hailey, ID 83333		RP0007700000B0	NRAP

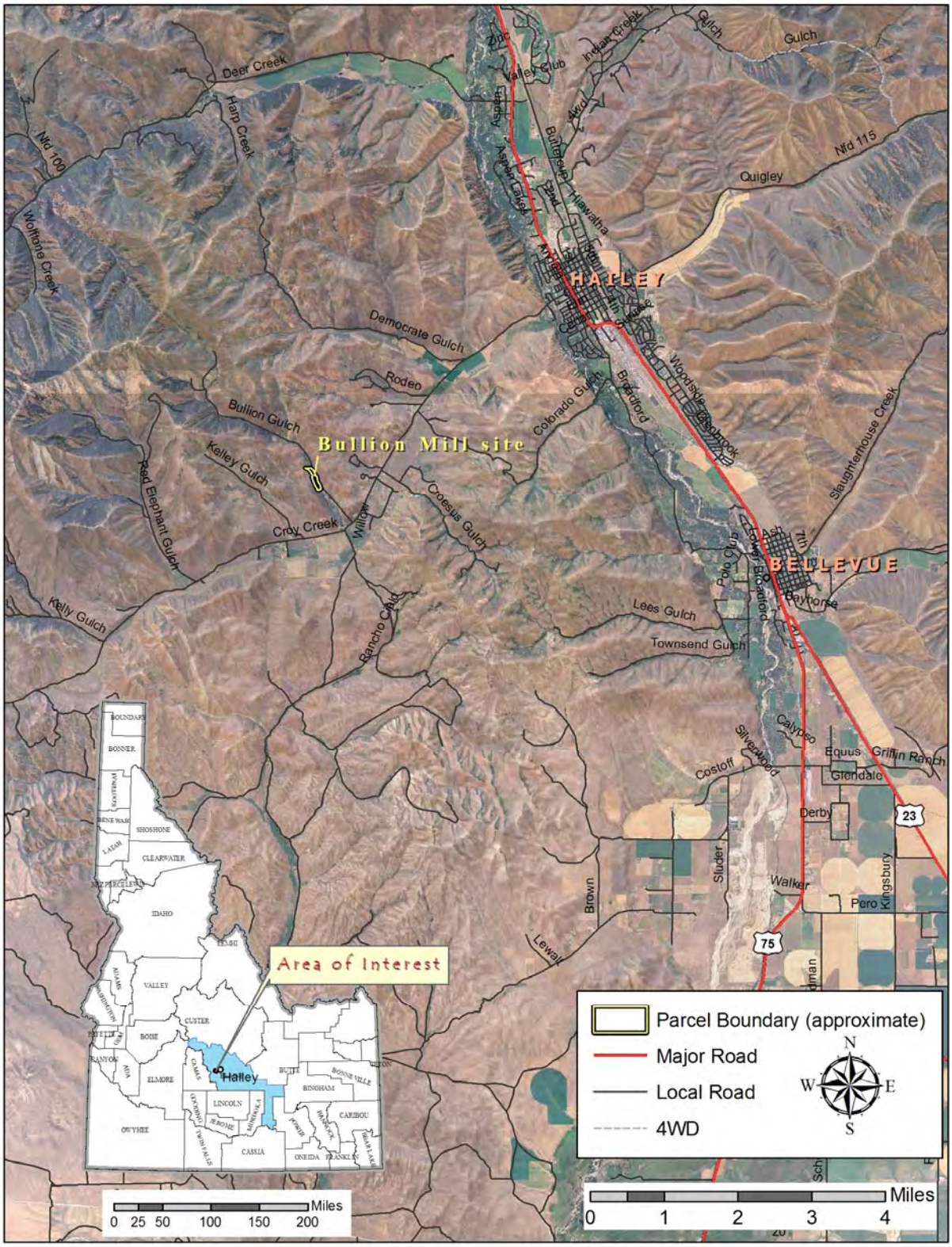

Figure 1. Location of the Bullion Mill site with USFS parcel data overlay (Map source: Fair 100k, Sunv 100k, NAIP 2004).

Section 3. Overview

The Bullion (Apache) Mill is located in Bullion Gulch, a tributary to the Croy Creek sub-drainage, approximately 4.5 miles west of Hailey, Idaho, in Sections 25 of Township 2 North, Range 17 East of the Boise Meridian, at Latitude DD: 43.48247, Longitude. DD: -114.38426. The millsite location is illustrated in Figure 1.

Directions to the mill site

The most direct route to the Bullion Mill is obtained by driving west from Highway 75 in Hailey onto Bullion Street. At the Big Wood River bridge the road's name changes to Croy Creek Road. One continues west for approximately 4 miles to the junction of Bullion Gulch Road. One turns right, proceeding north up Bullion Gulch Road for approximately 0.75 miles to reach the millsite. The road is graveled for the first 0.5 miles afterwards high-clearance vehicles are recommended. The mill property lies between the road and the gulch bottom to the west. An old access road which is partially blocked by the owner, leads through the property and reconnects with Bullion Gulch road approximately 0.3 miles to the north. An east-west trail frequently accessed by off road vehicles (ORV) cuts through the property. Figure 2 shows the approximated parcel boundaries and structures at the millsite.

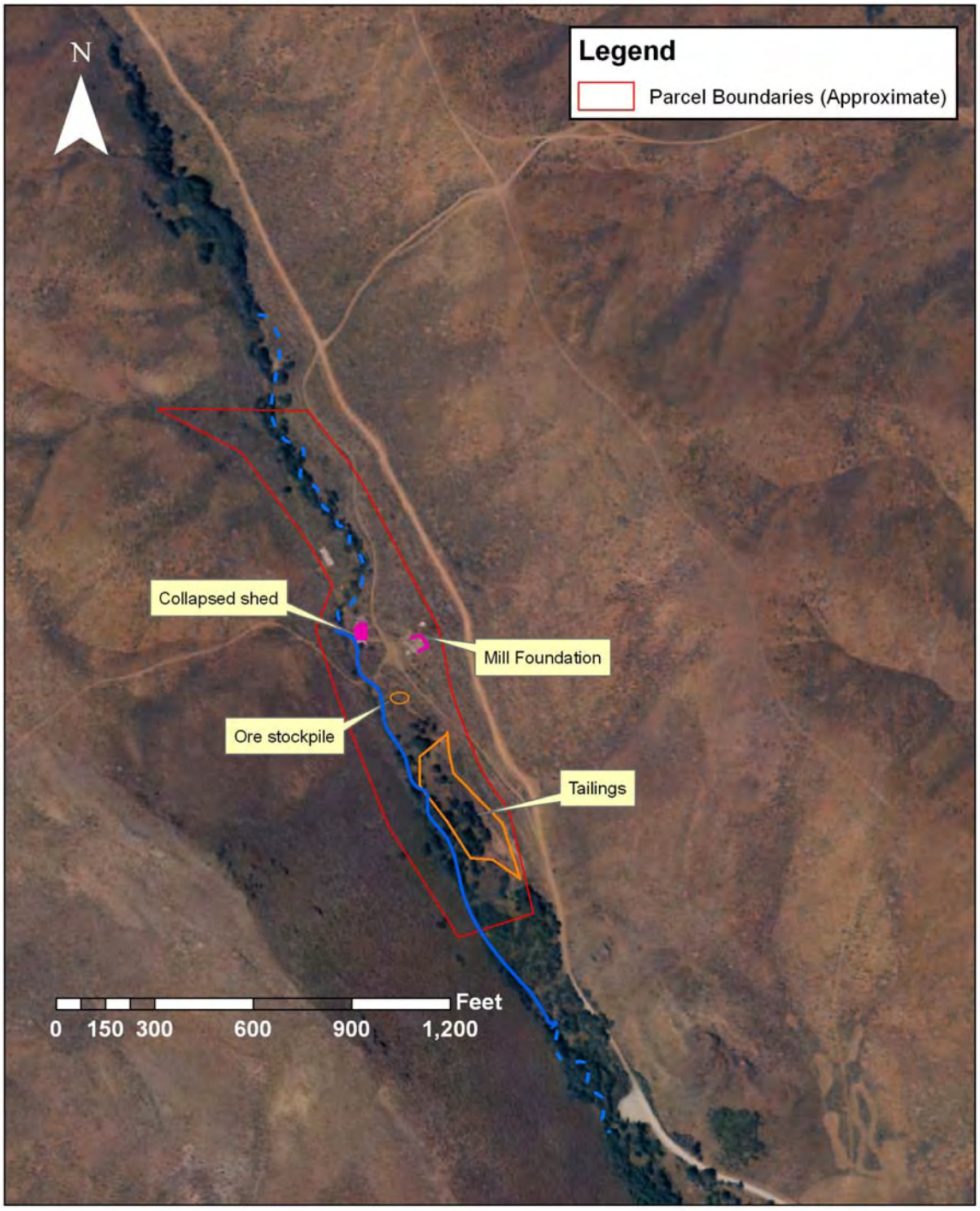

Figure 2. Bullion Mill site and notable features (Map source: Fair 100k, Sunv 100k, NAIP 2004).

Section 4. Mine Site History

Several mines lie within or adjacent to Bullion Gulch, once designated as the “Bullion District”. Many of the higher producing mines were located within the Mayflower fault zone. The Mayflower, Jay Gould, Bullion, Ophir and Durango mines trace the Mayflower vein. Most of these mines were interconnected. The Red Elephant mine located in Red Elephant Gulch, a few miles to the west of Bullion Gulch, supplied a portion of the ore processed in the mill.

In 1895, Polly Chamberlin received a 160 acre patented homestead part of which became the Bullion Mill site. The property was later acquired by the Apache Mines Company which operated the mill, which then became known as the apache mill.

DEQ could only identify a few historical accounts of the operation of the Bullion mill and its production. As subsequently discussed in this report, the tailing piles generated from these operations appears limited and the mill was reported to have burned down after only a few years of operation.

> *The Apache Mines Co. completed constructing a 100-ton flotation mill at the Bullion-Red Elephant property near Hailey in 1949 and during the latter half of the year treated 2,930 tons of-zinc-lead ore* (Needham & Luff, 1951, p. 1469).
>
> *The Snyder Mining and Development Co. worked the Apache Mines from September through December and treated 3,200 tons of zinc-lead ore in the 100-ton flotation mill at the property* (Robertson & Halverson, 1952, p. 1490).

Section 5. Climate

Climate information provided in this section is based on a climatological summary for Hailey, Idaho which was obtained from the National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center. The climatological data collected at the Hailey Airport (elevation 5,328 amsl), is for the period of 1951 through 1980. Each site for which this data is used is subject to more localized meteorological conditions that result from difference in elevation, orientation of slopes in watershed, vegetation and other factors.

The region is characterized by short cool dry summers and very cold winters. The total annual precipitation measured at the Hailey Airport averages 16.2 inches. The majority of precipitation occurs as snow. Total annual snowfall averages 78.2 inches with most snowfall occurring in December and January. The driest months are July, August and September.

Based on records from 1951 to 1980, the average annual temperature measured at the Hailey Airport is 43 degrees Fahrenheit (F). The lowest temperature recorded for this period was – 28 degrees F in 1962. The highest temperature for this period of record was 100 degrees F in 1953. January is the coldest month with an average temperature of 19.5 degrees F. July is the hottest month with an average temperature of 67 degrees F.

Section 6. General Geology

Numerous geology and mineral resource studies of the Wood River and adjacent areas have been accomplished. Geologic studies have been conducted to investigate mineral deposits (Lindgren, 1900 & 1933; Umpleby et al, 1930; Anderson and Wagner, 1946; Anderson et al, 1950; Hall et al, 1978; Wavra and Hall, 1989; Link and Worl, 2001; Worl and Lewis, 2001); individual formations and units (Hall et al, 1974; Sandberg et al, 1975; Wavra and Hall, 1986; Worl and Johnson, 1995); quadrangles (Batchelder and Hall, 1978; Mitchell et al, 1991; Kiislgaard et al, 2001) and to compile regional information (Rember and Bennett, 1979). Preliminary and environmental assessment investigations have been conducted to assess current and potential impacts from historic mining in the region (Mitchell and Gillerman, 2005; DEQ, 2002 & 2008; E & E, 2007).

Generally speaking the Croy Creek basin is hosted by sheared and altered quart monzonite intrusives, with a basal chert-pebble conglomerate; of the Wood River formation. Figure 3 shows the generalized geology of the Bullion Mill area.

> *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 that host many of the ore deposits in the Wood River region. They also host rather large intrusive bodies of diorite and quartz monzonitic rock which are regarded as outliers of the Idaho batholith. There is 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 (1950, p. 7) went on to note that, "The folding within the area is comparatively simple and consequently faulting constitutes the outstanding feature."

In discussion of the Red Elephant and Bullion areas Link and Worl (2001) described geologic and historic information relating to stratigraphy and mineralization relationships within Dollarhide sedimentary sequences in the Mineral Hill district.

> *The Bullion mineralized area...is underlain by the lower and middle members of the Pennsylvanian and Permian Dollarhide Formation, which is folded into upright and west-overturned 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).

6.1 Site Geology

The lower portions of Bullion Gulch, an ephemeral drainage, contain thick layers of colluvial fill, which are predominantly sandy remnants of the decomposed quartz monzonite. The colluvium is extremely erodible, and generally deeply incised. As reported by IGS in 2005, the mill site included two shallow shafts. Based upon the unconsolidated nature of these sediments, the purpose of the shafts could not be determined.

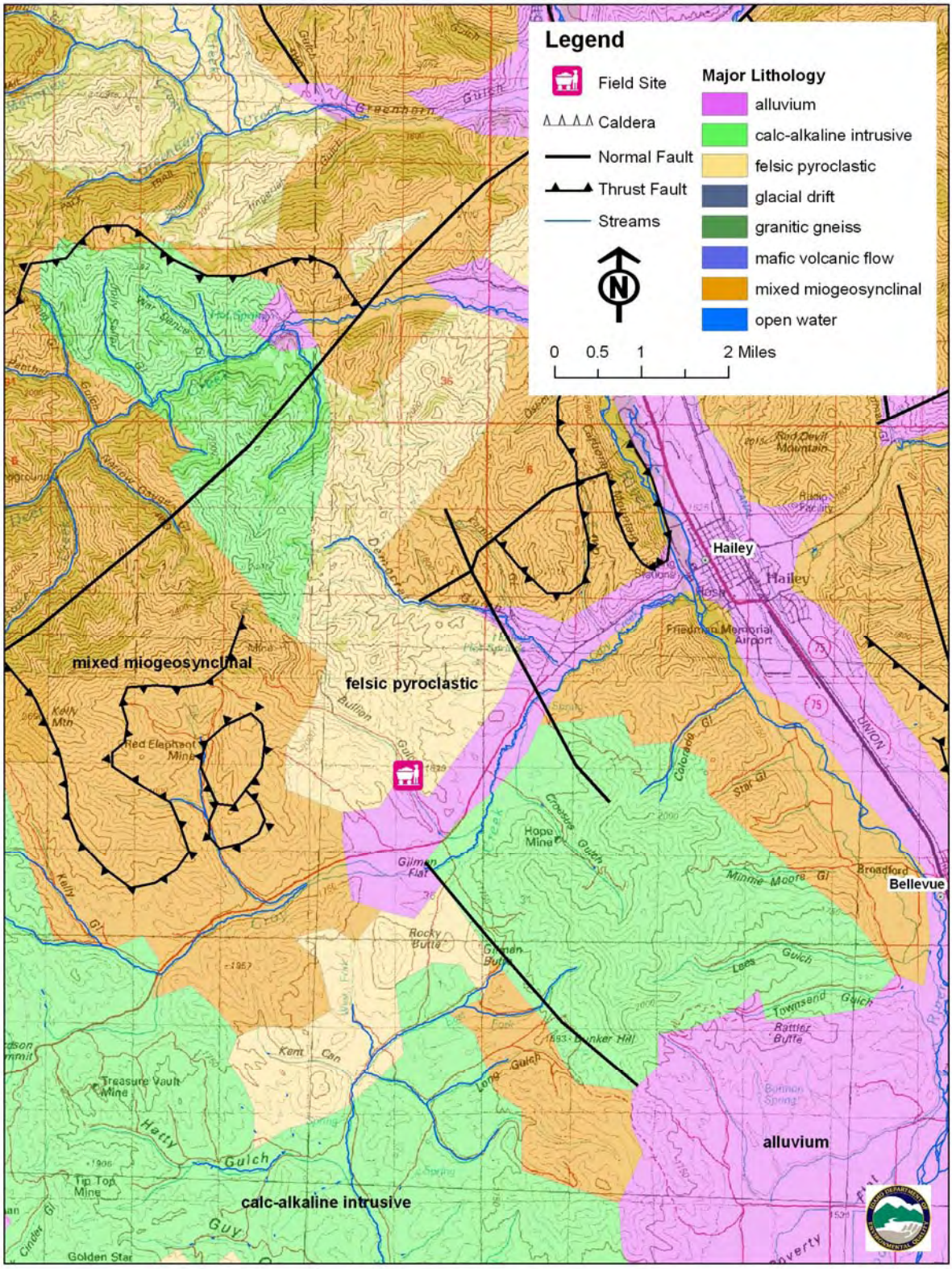

Figure 3. Geology of the Bullion Mill area (Map source: USGS 24k).

Section 7. Current and Potential Future Land Uses

7.1 Current Land Uses

Current land uses in the Croy Creek sub-drainage and adjacent tributary areas include residential housing and recreational activities such as biking, hiking, hunting, horseback riding and off-road vehicle (ORV) touring. Only the lower most portion of Bullion Gulch has residential housing. Occupancy appears to be seasonal for these residences, however.

Public access to the Bullion millsite is generally unrestricted, though private property is posted. During several DEQ site visits to Bullion Gulch properties, mountain bikers and hikers were frequently observed throughout the entire reach of the gulch.

7.2 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. It appears likely that access to the properties may increase as the local populations and recreation industry expands. However, at this time Blaine County has zoned the Bullion millsite property as an "unbuildable lot" and consequently, residential occupancy of the site is prohibited by the County.

Section 8. Site Conditions and Waste Characterization

In July 2006, DEQ in conjunction with E&E conducted a PA/SI which included the millsite and whose findings were reported in E & E's *Croy Creek Site Inspection Report* (2007).

The following descriptions are from the E&E report.

> *Two background surface soil samples (BGBG02SS and IMBG01SS) were collected from locations upgradient of mines/mills on Bullion Gulch. These samples were collected from 0 to 6 inches bgs. Sample BGBG02SS consisted of dry light brown sandy silt with some fine gravel and a slight amount of organics. Sample IMBG01SS consisted of dry brown silt to fine sand with approximately 10% gravel and a moderate amount of organics. These two samples will be used for comparison to all waste rock, mill building soil, and tailings pile samples collected within the Bullion Gulch drainage basin.*
>
> *Analytical results of sample BGBG02SS indicate the presence of fourteen TAL metals in this sample including antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, silver, vanadium, and zinc. Analytical results of sample IMBG01SS indicate the presence of eleven TAL metals in this sample including arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, vanadium, and zinc.* (E & E, 2007, p. 5-2)
>
> *The Bullion Mill, associated with the Bullion Mine, contained one mill building (Mill Building 1) and one tailings pile (Tailings Pile 1; Figure 6-9). The volume of the sampled sources; and their associated sample numbers and analytical results are presented below:*
>
> - ***Mill Building 1** – The mill building area was not measured by the field team, but is estimated from the site map to be approximately 75 feet by 50 feet. Using these values, the mill building area is calculated to be approximately 3,750 square feet. Three soil samples (BMMB01SS, BMMB02SS, and BMMB03SS) were collected at the mill. Sample BMMB01SS was collected at the top of the mill building area; and samples BMMB02SS and BMMB03SS were collected from the bottom of the mill building area. Analytical results from sample BMMB01SS indicates the presence of eight TAL metals at significant concentrations with respect to background concentrations (Table 6-7). Analytical results from sample BMMB02SS indicates the presence of ten TAL metals at significant concentrations with respect to background concentrations (Table 6-7). Analytical results from sample BMMB03SS indicates the presence of five TAL metals at significant concentrations with respect to background concentration (Table 6-7).*
>
> - ***Tailings Pile 1** - The tailings pile measured 538 feet long by an average of 234 feet wide covering an area of approximately 125,892 square feet. Three tailings samples BMTP01SS, BMTP02SS, and BMTP03SS) were collected. Analytical results from samples BMTP01SS and BMTP02SS indicates the*

> *presence of nine TAL metals at significant concentrations with respect to background concentrations (Table 6-8). Analytical results from sample BMTP03SS indicates the presence of seven TAL metals at significant concentrations with respect to background concentrations (Table 6-8).*
>
> (E & E, 2007, p. 6-8)

During a site visit in July 1998, a field team from the Idaho Geological Survey (IGS) conducted a site visit at the Bullion Mill and produced a site report. A portion of their report, including a detailed site sketch (Figure 4) and photographs are included in this preliminary assessment report. A copy of the IGS' Bullion Mill field report is included as Attachment 1.

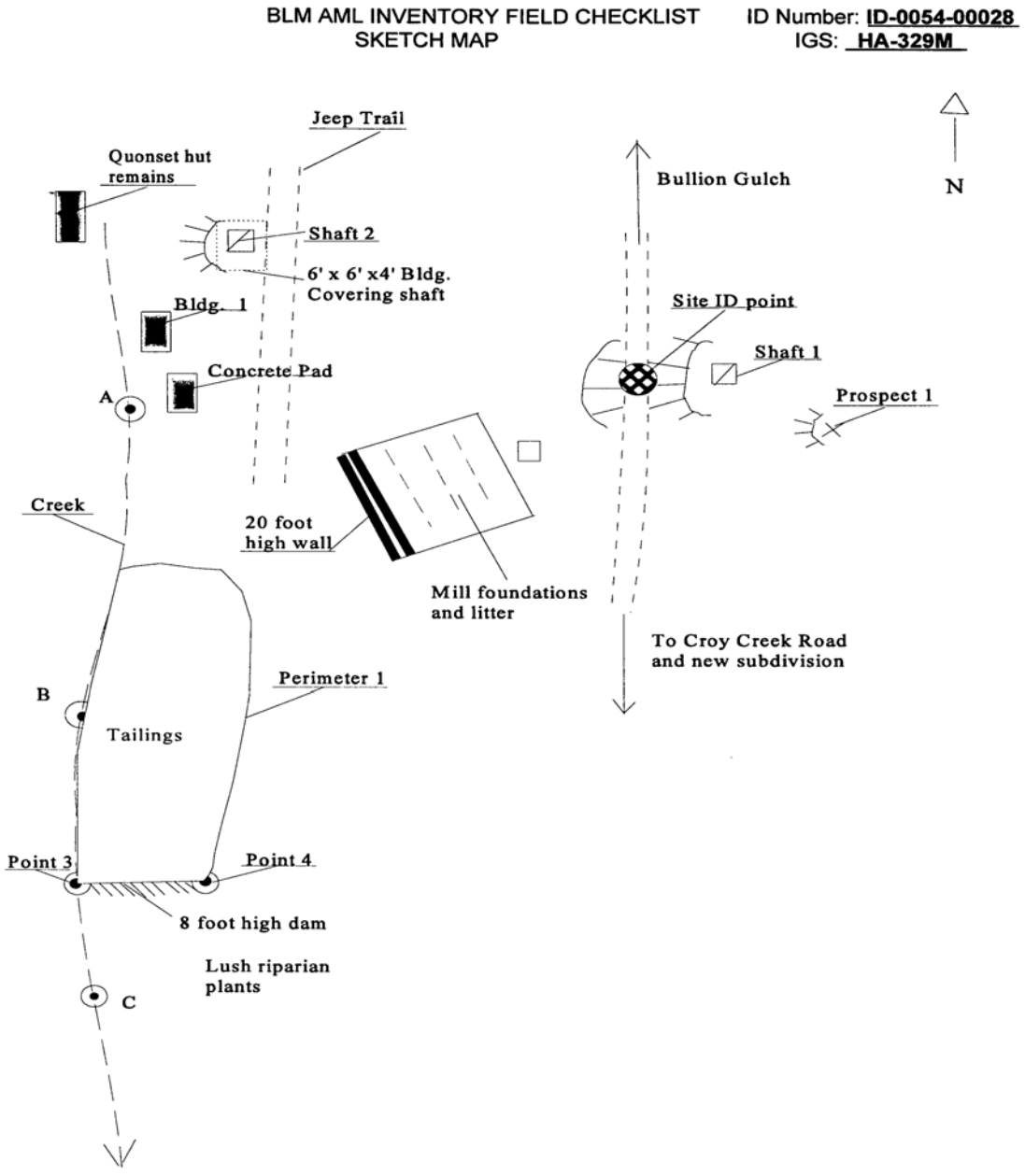

Figure 28-1. Sketch map of the Bullion Mill site.

Figure 4. Bullion Mill site sketch map (IGS, 2005, p. 34).

Figure 28-3. Shaft 1 at Bullion mill site is just a few timbers. Concrete pad in background is across road. Picture is looking to southwest. (Roll 98-9, neg. #6738, frame #19; photograph by V. S. Gillerman; July 16,1998).

Figure 28-4. Bullion mill foundation with old building in back. Picture is looking to southwest. (Roll 98-9, neg. #6738, frame #20; photograph by V. S. Gillerman; July 16,1998).

Figure 28-7. Bullion mill shaft # 2 interior - a decline open to 30 feet. Structure is caving in, but there is recent can at bottom of shaft. Picture is looking to northeast. (Roll 98-9, neg. #6738, frame #23; photograph by V. S. Gillerman; July 16,1998).

Figure 28-8. The Bullion mill site from lower elevation. Picture is looking to north. (Roll 98-9, neg. #6738, frame #24; photograph by V. S. Gillerman; July 16,1998).

Figure 28-9. Bullion mill tailings, fine and sand sized, with campfire, party remains, and human litter. Sage brush grows on tailings, and there is lush riparian vegetation and aspen along adjacent creek. Picture is looking to south. (Roll 98-9, neg. #6738, frame #25; photograph by V. S. Gillerman; July 16,1998).

Figure 28-10. Bullion mill tailings, un-vegetated and also with good sage and aspen cover. Note local caliche (?) on top. Picture is looking to northwest. (Roll 98-10, neg. #6737, frame #01; photograph by V. S. Gillerman; July 16,1998).

Section 9. Soil & Sediment Sample Collection

Bullion Mill (Apache)
DEQ and E & E collected two background samples from locations upgradient of the mines/mills of Bullion Gulch, three soil samples at the mill building, three tailings samples and two probable points of entry soil/sediment samples. Figure 5 shows the sample locations at the millsite. Background sample locations are described, but not shown.

Background soil sample [BGBG02SS] was collected near the ridge line above the Bay State claim in upper Bullion Gulch. A second background sample [IMBG01SS] was collected upgradient of the Idahoan mine workings. Both of these samples were deemed applicable for screening level comparisons to the lower elevation facilities.

Surface soil (0 to 6 inches below ground surface [bgs]) samples were collected using dedicated plastic spoons. Collected material was placed in a dedicated plastic bowl, thoroughly homogenized, and placed into a pre-labeled container (E & E, 2007, p. 3-4).

PA/SI sample naming convention is as follows:

- The first two letters represent the mine.
  - BM – Bullion Mill
- The next two letters are a description of the sample type.
  - BG – background
  - TP – tailings pile
  - PP – probable point of entry
- The are numbered sequentially
- The final two letters represent the sampled media
  - SS – soil
  - SD – sediment

For example: BMTP01SS was the first soil sample collected at the Bullion Mill from a tailings pile.

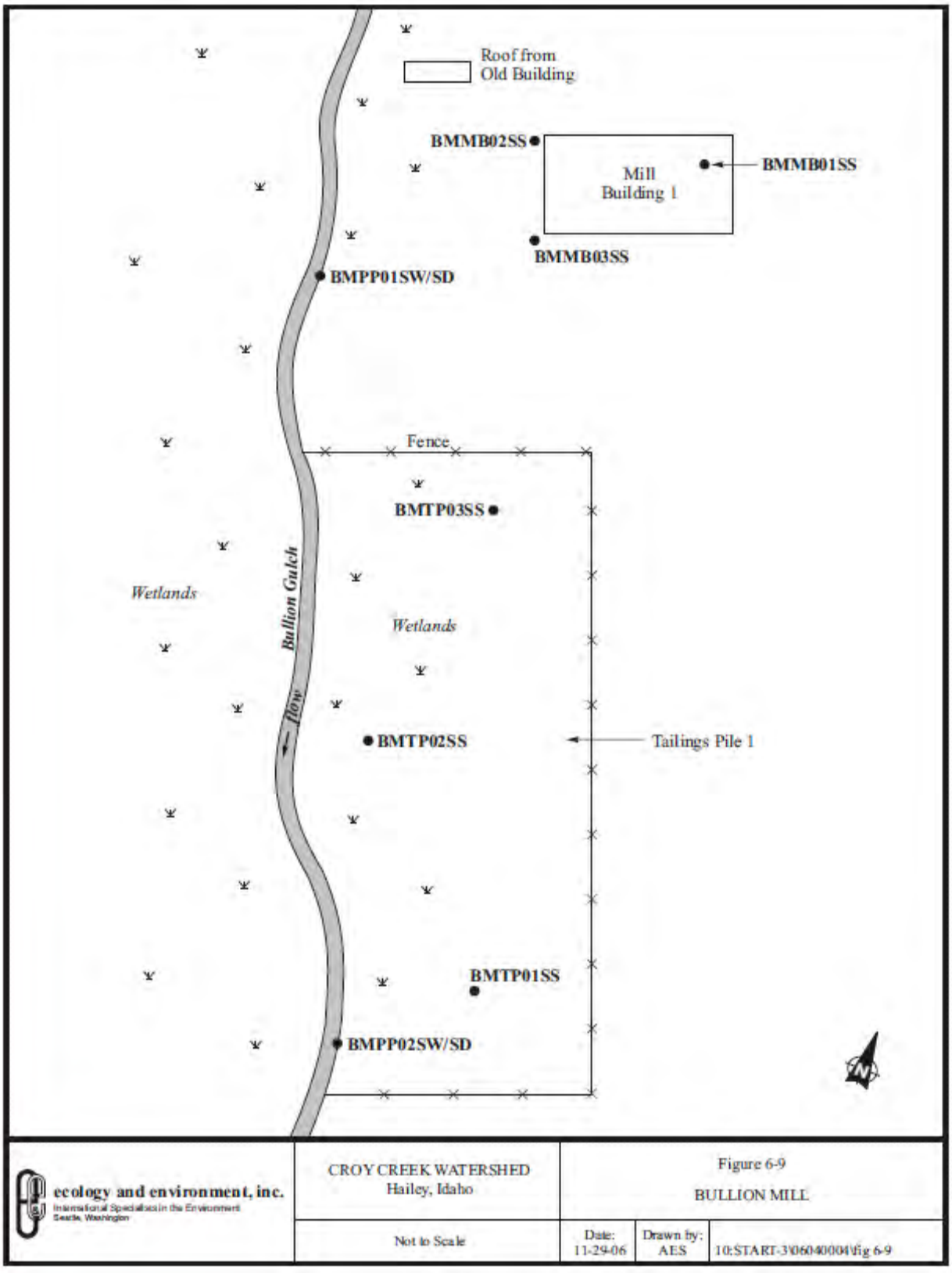

Figure 5. Drawing of Bullion Mill sampling locations, tailings, and structures (from E&E, 2007).

9.1 Soil Analysis

A summary of laboratory results from E&E soil and sediment samples are presented in Table 1.

Laboratory analysis of the soil background samples (BMBG02SS and IMBG01SS) and the sediment background samples (BMBG01SD and IMBG01SD) showed arsenic, cadmium, iron, lead, magnesium, manganese, mercury, silver and thallium concentrations in exceedance of Idaho's *Initial Default Target* (IDTLs). Arsenic exceeded both the IDTLS and EPA Region 6's Preliminary Human Health Screening Levels (HHSLs) in background samples BMBG02SS and IMBG01SD. IDTLs are very conservative risk based soil screening levels developed by the state of Idaho to provide preliminary screening levels for contaminants. HHSLs used in this report are health based screening levels developed by EPA for a residential scenario.

Mill Building
The laboratory analytical result's of soil samples BMMB01SS and BMMB02SS showed concentrations of antimony, arsenic, cadmium, iron, lead, manganese, mercury, silver and zinc above the background sample concentrations, IDTLs, and HHSLs. BMMB03SS did not exceed HHSLs for cadmium, iron and manganese.

Tailings Pile
The laboratory analytical result's of soil samples BMTP01SS, BMTP02SS and BMTP03SS showed concentrations of arsenic, lead and manganese above the background sample concentrations, IDTLs, and HHSLs. BMTP01SS and BMTP02SS exceeded HHSLs for cadmium and BMTP02SS and BMTP03SS exceeded HHSLs for iron. Concentrations for many of these constituents were greater than three times the background concentration (See Table 1).

9.2 Sediment Analysis

The laboratory analytical results of the background samples [BGBG01SD & IMBG01SD] and BMPP02SD showed concentrations of arsenic above IDTLs and HHSLs; BMPP01SD arsenic concentrations were just below the HHSL threshold. BMPP02SD also exceeded all three comparative values for lead.

Table 1: Total Recoverable Metals Analysis

Bullion Mill Soil/Sediment Samples						
			Background		Sample No	
	IDTLs	EPA Region 6 HHSLs			Bullion Mill	
Description	Units: mg/Kg		BGBG01SD	IMBG01SD	BMPP01SD	BMPP02SD
Aluminum	NSC	76,000	13500	8,250	4340	13400 JL
Antimony	4.77	314	2.1 JL	2.0 JQ	**2.7 JQ**	**11.9 JQ**
Arsenic	0.391	21.65	57.2	22.6	20	**109 JL**
Barium	896	15,642	139	74.9	23.2 JQ	69.7
Beryllium	1.63	150	0.92	0.47 JQ	0.27 JQ	0.53 JQ
Cadmium	1.35	39	9.8	3.9	4.1	**10.3**
Calcium	NSC	NSC	8250	7,630	**73900**	**15900**
Chromium	NSC	NSC	25.8	16.3	25.7	**34.3 JL**
Cobalt	NSC	900	9.3	4.1 JQ	1.8 JQ	7.4 JQ
Copper	921	2,900	46.6	34.4	11.3	**58.7**
Iron	5.76	55,000	24500	12,600	7820	**29100**
Lead	49.6	400	223 JL	72.9 JL	**257 JL**	**1780 JL**
Magnesium	223	NSC	4510 JL	2,060	2940 JL	**7300 JL**
Manganese	223	3,239	1160	618	303	**3050 JL**
Mercury	0.00509	23	0.16 U	0.088 JQ	0.095 JQ	**0.42**
Nickel	59.1	1,600	48.2	16.5	11	20.4 JL
Potassium	NSC	NSC	2900	1,510 JH	302 JQ	1230
Selenium	2.03	391	1.9 JQ	0.44 JQ	0.37 JQ	**7.7 UJL**
Silver	0.189	391	1.8	0.51 JQ	**2.9**	**16.4**
Thallium	1.55	5.5	1.1 JQ	2.6	**3.0 U**	**5.5 UJL**
Vanadium	NSC	390	56	86.6	11.1	52.6
Zinc	886	23,464	822	318	412	**2190 JL**

Notes: **Bold – values above background** **Underlined** – value>3x background - value above HHSLs Blue – above IDTL values

J – The associated value is an estimated quantity K - Unknown bias H – High bias L - Low bias

Q - The detected concentration is below the method reporting limit/contract required quantitation limit, but is above the method quantitation limit.

NA – Not Analyzed,

U - The material was analyzed for, but was not detected above the level of the associated value

Table 1: Total Recoverable Metals Analysis (continued)

Bullion Mill Soil/Sediment Samples

		EPA Region 6	Background		Sample No.					
	IDTLs	HHSLs			Mill Building			Tailings Pile		
Description	Units: mg/Kg		BGBG02SS	IMBG01SS	BMMB01SS	BMMB02SS	BMMB03SS	BMTP01SS	BMTP02SS	BMTP03SS
Aluminum	NSC	76,000	15000	9440	4970	3080	11500	3350	2600	2320
Antimony	4.77	314	2.0 JL	1.7 JQ	**43.1 JL**	**30 JL**	**5.4 JQ**	**17.1 JL**	**42.4 JL**	**11.5 JL**
Arsenic	0.391	21.65	76.4	19.8	**137**	**290**	**58.2**	**416**	**557**	**102**
Barium	896	15,642	127	119	30.5	31.3	121	28.1	25.9	20.5
Beryllium	1.63	150	0.99	0.49 JQ	0.34 JQ	0.24 JQ	0.68	0.39 U	0.31 U	0.27 U
Cadmium	1.35	39	6.3	3.3	**72.5**	**64.1**	**24.3**	**69**	**75.5**	**19.3**
Calcium	NSC	NSC	5290	2770	**28300**	**29000**	4240	**47000**	**30600**	**29900**
Chromium	NSC	NSC	29.2	13.1	22.3	19.3	**35.1**	24.4	18.2	17.3
Cobalt	NSC	900	9.5	5.6 JK	0.33 JQ	1.6 JQ	8.6	2.0 JQ	1.9 JQ	1.3 JQ
Copper	921	2,900	53.6	27.6	**234**	**183**	**115**	**277**	**202**	**114**
Iron	5.76	55,000	24700	13100	**114000**	**82100**	24100	**36100**	**74600**	**123000**
Lead	49.6	400	221 JL	50.9 JL	**14500 JL**	**8030 JL**	**2580 JL**	**4730 JL**	**10800 JL**	**3800 JL**
Magnesium	223	NSC	5230 JL	2600	**9730 JL**	**5800 JL**	**4480 JL**	**7920 JL**	**5750 JL**	**9720 JL**
Manganese	223	3,239	907	531	**32700**	**19000**	**967**	**8840**	**19900**	**32700**
Mercury	0.00509	23	0.10 U	0.049 JQ	**1.3**	**1.1**	**0.91**	**1.2**	**0.84**	**0.45**
Nickel	59.1	1,600	50.5	19.2	12.9	14.8	17.8	13.8	14.3	18.6
Potassium	NSC	NSC	2800	1970 JK	305 JQ	231 JQ	2300 JH	476 JQ	159 JQ	120 JQ
Silver	0.189	391	1.5	0.28 JQ	**147**	**93.1**	**37.2**	**56.4**	**90.1**	**37.8**
Vanadium	NSC	390	140	65	8.9	12.5	50.8	13.9	17.9	8.6
Zinc	886	23,464	718	261	**12000**	**9180**	**3350**	**10200**	**9900**	**2820**

Notes: **Bold – values above background** **Underlined** – value>3x background ☐ - value above HHSLs Blue – above IDTL values

J – The associated value is an estimated quantity K - Unknown bias L - Low bias Q - The detected concentration is below the method reporting limit/contract required quantitation limit, but is above the method quantitation limit. NA – Not Analyzed, U - The material was analyzed for, but was not detected above the level of the associated value H – High bias

Section 10. Surface Water Sample Collection

Surface water samples were collected either by hand-dipping the pre-preserved sample container into the water (if possible) or by creating a funnel with a dedicated 1-liter polyethylene sample bottle, with the bottom of the bottle removed into a pre-preserved sample container (E & E, 2007, p. 3-4).

One background surface water sample UTBG01SW was collected from an unnamed tributary to Bullion Gulch in the area of the Gold Bottom Mine. The sample had a pH of 7.76 and a conductivity of 0.604 mS/cm. This sample will be used for comparison to all surface water samples collected in the Bullion Gulch drainage basin (ibid, p.5-3).

Two surface water samples [BMPP01SW and BMPP02SW] were collected from PPEs at the Bullion Mill. Both were collected in Bullion Gulch. Sample BMPP01SW was collected downgradient of the mill building and BMPP02SW was collected downgradient of the tailings pile. Surface water sample BMPP01SW had a pH of 7.33 and a conductivity of 0.487 mS/cm. Surface water sample BMPP02SW had a pH of 7.58 and a conductivity of 0.471 mS/cm.

> *Analytical results of sample BMPP01SW indicate the presence of lead at an elevated concentration with respect to the background concentration (Table 7-3). Analytical results of sample BMPP02SW did not indicate the presence of any TAL metals at elevated concentrations with respect to background concentrations (Table 7-3).*
>
> (E & E, p. 7-5)

10.1 Results

The background water sample UTBG01SW shows elevated levels of aluminum and iron. Background lead levels were high, but below the standards. Analytical results of sample BMPP01SW indicate the presence of lead at an elevated concentration with respect to background concentrations, but BMPP02SW did not indicate the presence of any metals at an elevated concentration with respect to background concentrations. The lead values exceed the DEQ cold water biota standards for Acute and Chronic criteria. The extent to which cold water biota may be affected by the elevated lead levels was not determined by DEQ.

Table 3: DEQ Water Samples Total Recoverable Metals Analysis (mg/L).
(Standards in "dissolved" unless stated)

Bullion Mine

	DEQ Ground Water Standard	DEQ Drinking Water Standard	DEQ Cold Water Biota Standard	DEQ Cold Water Biota Standard	Background Sample Unnamed tributary (Gold Bottom area)	Bullion Mill Water Sample	Bullion Mill Water Sample
	(T)	MCL	Acute	Chronic			
Description					UTBG01SW	BMPP01SW	BMPP02SW
Aluminum	0.200				0.287	0.0793 JQ	0.200 U
Antimony	0.006	0.006			0.0017 JQ (0.060 SQL)	0.003	0.0024
Calcium					87.400	72.400	77.0
Iron	0.3*				0.470	0.187	0.100 U
Lead	0.015	0.015	0.014 (H)	0.00054 (H)	0.014	**0.0442**	0.0068 JQ
Magnesium					3.580 JQ	7.860	12.3
Manganese	0.05*				0.047	0.0348	0.015 U
Zinc	5*		0.035 (H)	0.032 (H)	0.081	0.0695	0.0793

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

Key:
J = Associated value is an estimated quantity.
Q = Detected concentration is below the method reporting limit/contract required quantitation limit, but is above the method quantitation limit.
SQL = Sample quantitation limit.

Section 11. Pathways and Environmental Hazards

11.1 Ground Water Pathways

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

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

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

- Defines the zone of contribution, which is that portion of the watershed or subsurface area contributing water to the well or surface water intake (**source area delineation**).

- Identifies the significant potential sources of drinking water contamination in those areas (**contaminant source inventory**).

- Determines the likelihood that the water supply will become contaminated (**susceptibility analysis**).

Each assessment is summarized in a report that describes the above information and provides maps of the location of the public water system, the source area delineation, and the locations of potential contaminant sources. Idaho began developing source water assessments in 1999, and in May 2003 met its obligation under the amendments of the Safe Drinking Water Act by completing delineations for all 2100+ public water systems that were active in Idaho as of August 1999 (DEQ 2000). Source water assessments for new public drinking water systems are being developed as those systems come online. Each public water system is provided with two copies of its final assessment report. Four source water assessments for drinking water supplies have been used in this Preliminary Assessment Process to evaluate the potential impacts to both

public and private drinking water supplies in and around Sun Valley, Ketchum, Hailey and Bellevue, Idaho.

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

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

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

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

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

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

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

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

The closest domestic drinking water well lies approximately 0.17 miles south-southwest of the Bullion millsite. There are 28 wells located within a distance of 1 mile; 72 wells located within a distance of 1 to 2 miles of the sites; seven wells within 2 to 3 miles; and 17 wells within 3 to 4 miles of the Bullion millsite. The majority of these wells are located at residences within and immediately adjacent to the Croy Creek Road area (Figure 6).

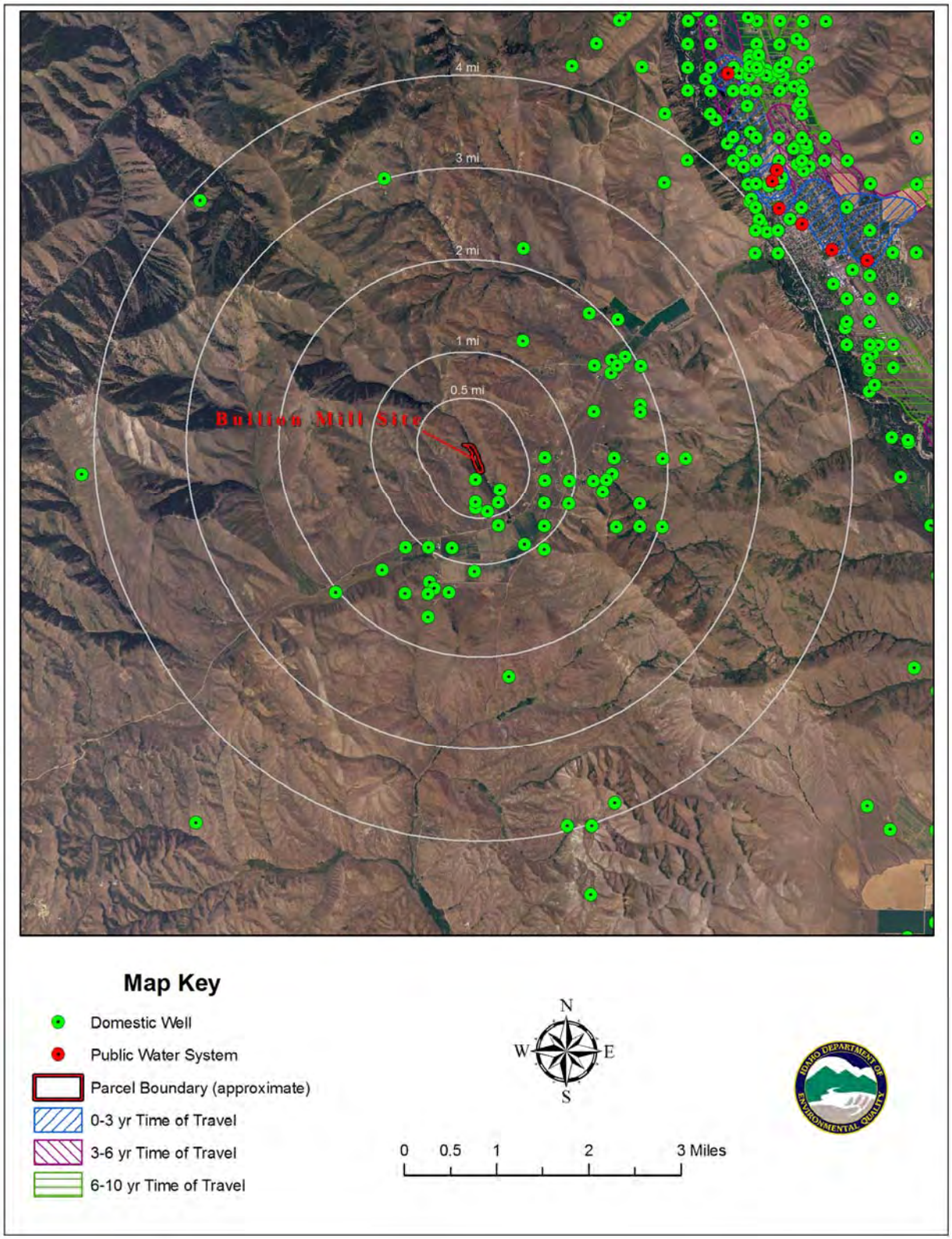

Figure 6. Drinking water well locations and source water delineations (Map source: NAIP 2004).

11.2 Surface Water Pathways

The surface water migration pathway target distance limit (TDL) begins at the probable point to entry of surface water runoff from a site to a surface water body and extends downstream for 15 miles. The surface water TDL for the Bullion Gulch sub-drainage is presented in Figure 7.

Bullion Gulch is an ephemeral stream through most of its reach. Stream flow resurfaces at the millsite and drains toward the south towards Croy Creek. However, the stream's connection with Croy Creek is not continuous, as at the time of the site visit the stream subsides into colluvial fill several yards down gradient of the mill. These relationships are illustrated in Figure 7. The Big Wood River is an EPA CWA §303(d) listed stream.

The probable point of entry of mill runoff into Croy Creek is approximately 0.95 miles to the south where Bullion Gulch enters Croy Creek. Several ephemeral drainages enter Croy Creek along its eastward flow to the Big Wood River, approximately 6 miles distant from the Bullion Mill. The 15-mile target distance limit (TDL) continues for approximately 8.5 miles on the Big Wood River south of the City of Hailey. There are not any surface water intakes for public drinking water systems within the 15-mile TDL. The Bullion millsite does not lie within a floodplain (FEMA 1998).

11.3 Air Quality Pathways

The Bullion millsite lies adjacent to Bullion Gulch Road and is readily accessible from adjacent BLM administered lands. DEQ observed off road vehicles (ORV), specifically motorcycles, traversing through the property. Such evidence of ORV activity suggests that the air quality pathway is complete and is significant. Furthermore, fugitive dust (mill fines) emissions to the local population, at least 0.25 miles distant, may also be significant.

11.4 Soil Exposure

According to DEQ's Risk Evaluation Manual if pathways are determined to be complete, or if pathways are anticipated to become complete as a result of future uses, and the IDTLs are exceeded for any constituents, two options should be considered:

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.

The soil exposure pathways are not currently complete for residential or construction worker receptors on the mill site. However, the non-residential receptor pathway is complete for recreational users. The residential pathway would likely be complete if the parcel is to be developed for residential housing and risk management is not incorporated in the development plans.

A cumulative risk and hazard index analysis was completed by DEQ staff using Idaho's Risk Evaluation Manual (REM). The analysis was performed for antimony, arsenic, cadmium, iron, lead, manganese, mercury, silver, and zinc.

Bullion Mill Building

Results of the analysis showed a cumulative risk ranging from 1.51×10^{-5} to 6.40×10^{-6} from soils collected near the remnants of the old mill and a cumulative hazard index ranging from1.88 to 0.30 for non-residential receptors. Both the risk and hazard indices are larger for the hypothetical future residential receptor. The primary driver for the risk index is arsenic with a risk of 3.19×10^{-5}, while the primary driver for the hazard index is manganese with a quotient of 1.02. Remedial action levels are typically set between 1×10^{-4} and 1×10^{-6} for risk and/or a hazard index of 1. Based on this analysis the human health risk and hazard associated are slightly elevated with frequent recreational use of the ground near the mill building through inhalation, dermal contact and ingestion of site soils.

Tailings

Results of the analysis showed a cumulative risk of 6.13×10^{-5} from soils collected from the tailings pile and a cumulative hazard index of 2.47 for non-residential receptors. Both the risk and hazard indices are larger for the hypothetical future residential receptor. The primary driver for both the risk and hazard indices is arsenic with a risk of 4.58×10^{-5} and a hazard quotient of 1.08. Remedial action levels are typically set between 1×10^{-4} and 1×10^{-6} for risk and/or a hazard index of 1. Based on this analysis the human health risk and hazard associated are slightly elevated with frequent recreational use of the tailings pile through inhalation, dermal contact and ingestion of site soils.

11.5 Domestic Wells and Public Water Supplies

There are approximately 124 domestic, commercial and municipal water wells within a four mile radius of the mine. No public water system wells or their zones of capture are located within a 4-mile radius of the Bullion millsite (Figure 6). The nearest domestic well is located approximately 0.17 miles down hydraulic gradient from the site near the mouth of Bullion Gulch. The six or so domestic wells locate at or near the mouth of Bullion Gulch are the most likely wells to be impacted by historic mining activities within Bullion Gulch. Analytical data pertaining to these wells were not available. DEQ recommends that owners of the wells have their well water tested on a regular basic for metals.

11.6 Residences, Schools and Day Care Facilities

The nearest residence is approximately 0.25 miles south of the Bullion millsite. There are not any schools or day care facilities within 200 feet of the Bullion millsite.

11.7 Wetlands

Significant (approximately 14 miles) wetlands, however, do exist along Croy Creek, from approximately 0.95 miles down stream of the mill site to the 15-mile TDL on the Big Wood River (Figure 7). Though wetlands are noted in Figure 5 by E & E (2007), their existence is

seasonal. Most likely, it appears that a wetland-type environment would occur during snow-melt driven spring flooding events (USFWS, 2009).

11.8 Sensitive Species (Plant and Animal)

Camas Golden weed (*Haplopappus insecticruris*) and Long-legged Myotis (*Myotis volans*) are listed as sensitive species located within a 4-mile radius of the millsite. North American wolverine (*Gulo gulo*) ranges are located within a 4-mile radius of the millsite. These relationships are illustrated in Figure 8.

11.9 Fisheries

Redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], wood river sculpin [Cottus leiopomus], and brook trout [Salvelinus foninalis] are present within Croy Creek. Redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], mountain white fish [Prosopium williamsoni], wood river sculpin [Cottus leiopomus], and brook trout [Salvelinus foninalis] are present within the Big Wood River (IDFG, 2000).

11.10 Sensitive Waterways

Croy Creek and the Big Wood Rivers are both Clean Water Act 303(d) listed streams down gradient from the Bullion millsite, which might be adversely affected by contaminant delivery from the site. However, the ephemeral stream draining Bullion Gulch likely only flows during spring runoff and runoff from the mill would provide only a small percentage to total stream flow.

11.11 Livestock Receptors

There was no indication that the area is used for livestock grazing. However, the Bullion millsite lies adjacent to the BLM's Bullion grazing allotment, indicating the potential for grazing to occur on the property.

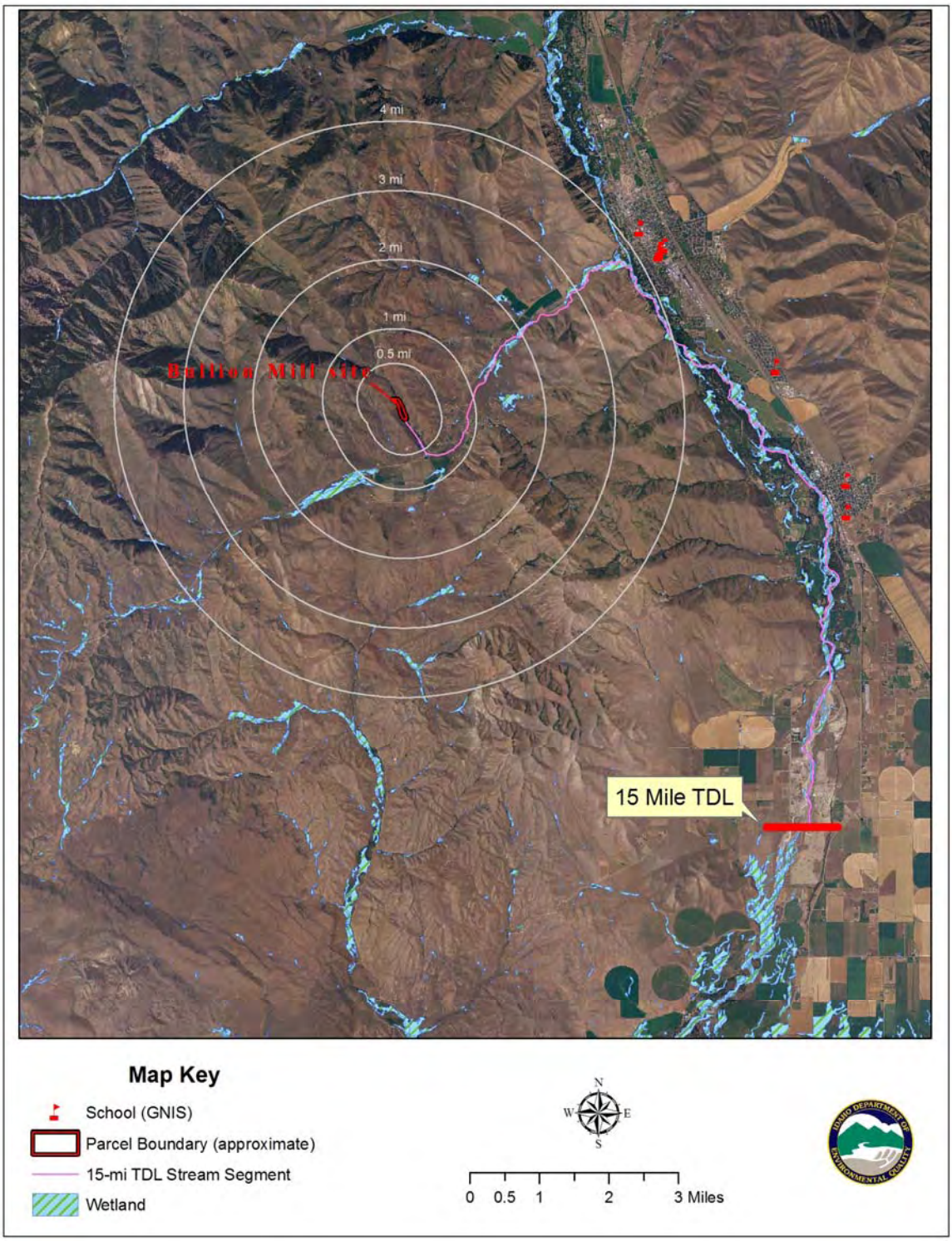

Figure 7. Wetlands and 15-Mile TDL map (Source Fair 100k, Sunv 100k, NAIP 2004).

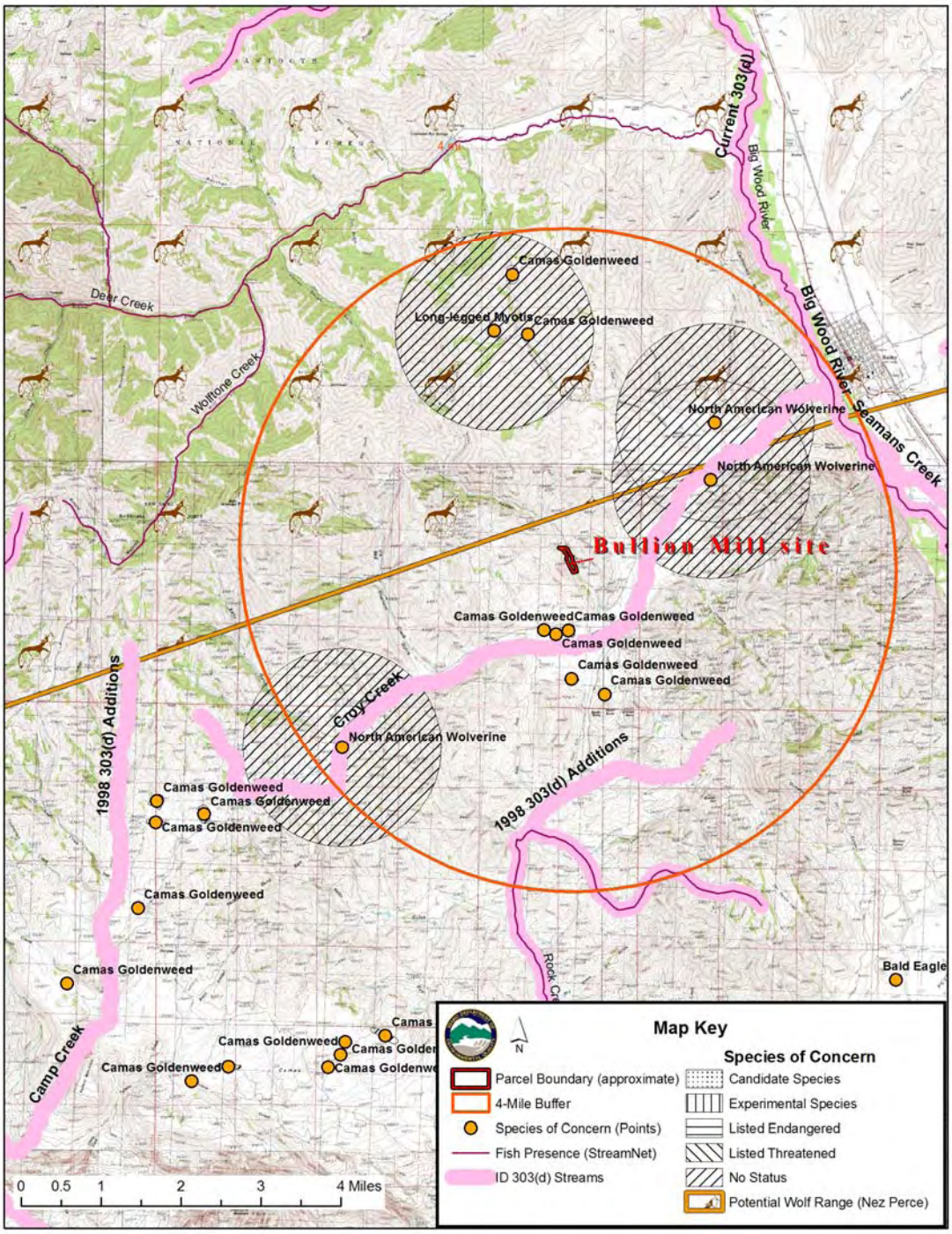

Figure 8. Sensitive species near the Bullion millsite (Source: Fair 100k, Sunv 100k, USGS 24K Topo).

Section 12. Summary and Conclusions

Based on the completeness of pathways between contaminated soils/tailings with recreational receptors, and potentially residential receptors, DEQ is making two recommendations to the owner; First is that the owner short circuits the pathways for exposure to recreational users at the site, and second that a reclamation plan is developed for the site to eliminate the erosion of tailings and soils at the site that have been destabilized by past activities. Relative to the first, DEQ suggests that there are a number of ways to short circuit the pathways including but not limited to posting the property, fencing the property, capping the tailings and contaminated soils in place, or removal and either reprocessing or disposal in a capped repository.

DEQ is also recommending that EPA run the site through the Hazard Ranking Score to determine if an additional Site Inspection is warranted. At this time DEQ suggests that the site is designated as an **Other Cleanup Action** as DEQ assumes that the owner will want to work voluntarily with DEQ to manage risks at the site.

DEQ also recommends that if this site is intended for residential development, further investigations and risk analysis should be conducted. Additional risk analysis based on this desired use will likely indicate that significant risk management will have to be incorporated in development and use plans.

Section 13. References

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, 2008, Blaine County Treasurer-Tax Collections, Hailey, Idaho

Bureau of Land Management, 2008, *Land Patent Details* – BLM GLO Records. http://www.glorecords.blm.gov/PatentSearch/Detail.asp?Accession=IDIDAA+046037&Index=1&QryID=41620.75&DetailTab=1

Bureau of Land Management, 2008, *Land Patent Details* – BLM GLO Records. http://www.glorecords.blm.gov/PatentSearch/Detail.asp?PatentDocClassCode=SER&Accession=IDIDAA+044521&Index=1&QryID=49139.84&DetailTab=1

Ecology & Environment, Inc. (E & E). November 2007. *Croy Creek Watershed Preliminary Assessment/Site Inspection Hailey and Bellevue, Idaho.* United States Environmental Protection Agency, Contract Number EP-S7-06-02, Seattle, Washington.

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

Federal Emergency Management Agency (FEMA). July 20, 1998. Flood Insurance Rate Map, Blaine County, Idaho (Unincorporated Areas), Community Panel Numbers 165167 0001-1950.

Idaho Department of Water Resources (IDWR), 2008. http://www.idwr.idaho.gov/water/well/search.htm

Idaho Department of Environmental Quality (DEQ), 2008. Safe Drinking Water Information System (SDWIS).

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

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

Idaho Geological Survey (IGS), Gillerman, V.S. & F.S. Griggs, 2005. *Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Bureau of Land Management Property in the Hailey-Bellevue Area: Bullion Gulch, Blaine County, Idaho.* Staff Report S-05-1

IDRW, 1992. Well Construction database. http://www.idwr.idaho.gov/apps/appswell/searchWC.asp

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.

Lindgren, Waldemar, 1900, *The gold and silver veins of Silver City, De Lamar, and other mining districts in Idaho:* U.S. Geological Survey Twentieth Annual Report, Part III, pp. 65-256

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.

Needham, C.E.; Luff, Paul, 1951, *Gold, silver, copper, lead, and zinc in Idaho,* Bureau of Mines / *Minerals yearbook 1949*, pp. 1458-1482

Robertson, Almon F.; Halverson, Virginia, 1952, *Gold, silver, copper, lead, and zinc in Idaho,* Bureau of Mines / *Minerals yearbook 1950,* pp. 1480-1500

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