SONNEMANN MINE & MILL
PRELIMINARY ASSESSMENT REPORT
OWYHEE COUNTY, IDAHO

STATE OF IDAHO

DEPARTMENT OF ENVIRONMENTAL QUALITY

December 2002

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

1.11.8.6

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

1410 North Hilton • Boise, Idaho 83706-1255 • (208) 373-0502

Dirk Kempthorne, Governor
Toni Hardesty, Director

December 20, 2005

Mr. Ken Marcie
U.S. Environmental Protection Agency
Site Assessment and Cleanup Unit
1200 Sixth Avenue
Seattle, Washington 98101

RE: Sonneman Mine and Mill Preliminary Assessment and site Inspection.

Dear Mr. Marcie:

The Idaho Department of Environmental Quality (DEQ) completed a preliminary assessment and site inspection (SI) of the Sonneman Mine and Mill Site with the cooperation of South Mountain Mines Incorporated (SMM). Although DEQ made recommendations for risk management of mine drainage and wastes at the site, SMM has not proposed any formal course of action. Never the less, DEQ is providing you with this notification that DEQ will not be pursuing any additional actions at the site at this time.

Should EPA determine that additional actions are warranted at the site, DEQ would appreciate an open dialogue to discuss that determination.

Sincerely,

Bruce A. Schuld
Mine Waste Projects Coordinator

Cc: Brian Gaber - DEQ Technical Services
Ken Henderson - South Mountain Mines Inc.
P.O. Box 160
Richfield, UT 84701
L. Heagney – South Mountain Mines Inc.
P.O. Box 1926 M-416
Spartanburg, SC 29304
Roger Milikin – South Mountain Mining Inc.
70 Blanchard Road
Cumberland, ME 04021
file

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS

Acronym	Definition
amsl	above mean sea level
BLM	United States Bureau of Land Management
DEQ	Department of Environmental Quality
EPA	United States Environmental Protection Agency
gpm	gallons per minute
PPE	Probable Point of Entry
TDL	Target Distance Limit
TMDL	Total Maximum Daily Limit

1. INTRODUCTION

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 a preliminary assessment (PA) at the Sonnemann Mine and Mill site located near South Mountain, Idaho, in Owyhee County. DEQ completed PA activities in accordance with the goals listed below.

The specific goals for the Sonnemann Mine and Mill PA, as identified by DEQ, are to:

- Determine the potential threat to public health or the environment posed by the site.
- Determine the potential for a release of hazardous constituents into the environment.
- Determine the potential for placement of the site on the National Priorities List.

Conducting the PA included reviewing existing site information, collecting receptor information within the site's range of influence, determining regional characteristics, and conducting a site visit. This document includes a discussion of site background information (Section 2), a discussion of migration/exposure pathways and potential targets (Section 3), and a list of pertinent references. Photographic documentation is included in Appendix A and sample analyses are included in Appendix B.

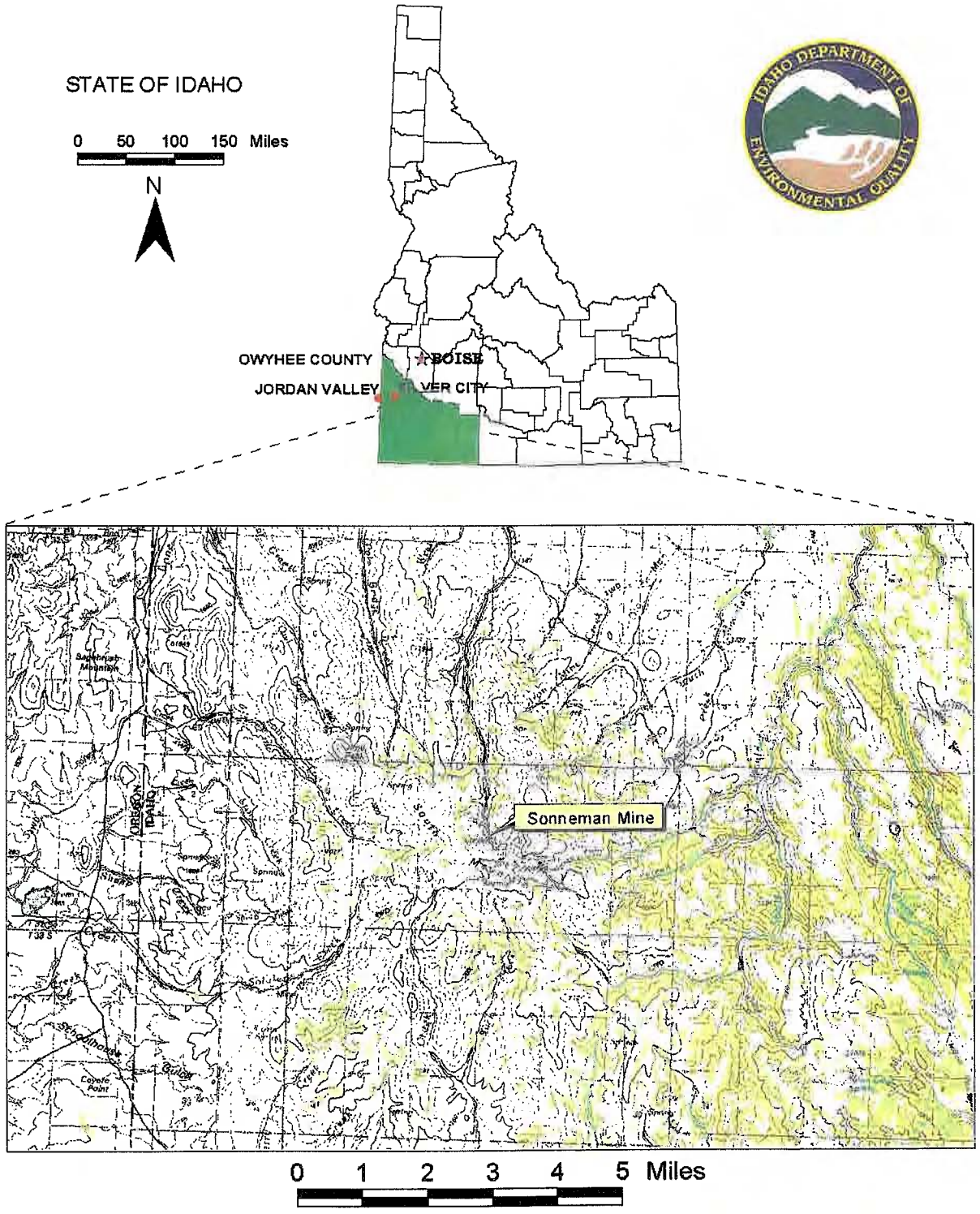
2. SITE BACKGROUND

2.1 SITE LOCATION

Site Name:	Sonnemann Mine and Mill
CERCLIS ID No.:	
Location:	Owyhee County, Idaho
Latitude:	42° 44' 43"N
Longitude:	116° 55' 13"W
Legal Description:	Section 10, Township 8S, Range 5W, Boise Meridian
Congressional District:	Idaho
Site Owner:	L. Heagney P.O. Box 1926, M-416 Spartanburg, SC 29304
Site Contact:	Kenneth Henderson 210 N 2450 E Richfield, UT 84701 (435) 201-9798

FIGURE 2-1

FIGURE 1 Site Vicinity Map of Sonneman Mine



2.2 SITE DESCRIPTION/OWNERSHIP HISTORY

Sonnemann Mine is a former silver and lead mine located in Owyhee County, Idaho, approximately 18 miles southeast of Jordan Valley, Oregon, and 20 miles south of Silver City, Idaho (Figure 2-1). The site is located near the headwaters of Williams Creek on the northwest flank of South Mountain. The mine was developed within the same sulfide-rich metamorphosed sediments as the old Golconda Tunnel located 0.20 miles southeast of the Sonnemann.

The mine was identified as the new Golconda Tunnel (Sorenson, 1927) and constructed as follows: "The new Golconda tunnel was started about 500 feet northwest of the old tunnel portal at an elevation 105 feet lower than the elevation of the latter. Reports indicate that the face of the tunnel is about 275 feet southeast from the portal, but the writer could not examine it because of the caved condition" (ibid. p. 43). Apparently, the new Golconda Tunnel was driven to intersect a "large body of sulfide ore, which was expected to be found underlying the oxidized surface expression of the hederbergite-ilvaite rock " (ibid. p. 43). According to Mr. Ken Henderson whom represents the owner of the Sonnemann, the tunnel was driven more than 3,000 feet and connects with the old Golconda Tunnel, the Laxey Mine and Texas Mine (Henderson, 2002).

Classification of ore deposits in the South Mountain Mining District, where the Sonnemann Mine is located, reveals typical contact metamorphic replacement and characteristic vein replacement deposits (Sorenson, 1927). The eastern portion of Williams Creek, including the Sonnemann and other mines within the Golconda Group, contains sulfide deposits from contact metamorphism of limestone units and the underlying granodiorite. The metamorphosed sediments appear to be a roof pendant in the granodiorite intrusive.

The ownership history of the Sonnemann Mine, also known as the new Golconda Tunnel, Sonneman Mine, and South Mountain Mine, is unclear. Two major veins of gold, silver, and lead were discovered in 1868 on South Mountain but were not developed until 1869. In 1874, a small smelter was established in the townsite of Bullion City, later renamed South Mountain, which lies 0.75 miles north of the Sonnemann Mine. Early ownership of the Golconda Group is vague but it has been reported that "in the fall of 1874, San Francisco parties bought up the more important mines and incorporated as the South Mountain Consolidated Mining Company. The Company opened up the Golconda, Bay State, Yreka and other mines" (V.P. Jennings, unpublished manuscript). Failure of the Bank of California on August 26, 1875, effectively shut down mining on South Mountain (ISHS, 1996). In the early 1900s, George A. Sonnemann of Spokane, Washington, organized the Golconda Group on patented claims. The Alabama claim encompasses the old Golconda Tunnel and Golconda stope while the Kentuck and Queen of the Mountains claims contain the Sonnemann Mine and Mill site.

In 1926, the Uida Consolidated Mines Company held the bond and option on the property of the South Mountain Mining Company, but records fail to show any mining operations conducted by this new company. Between August 9, 1940, and November 30, 1946, the

South Mountain Mining Company was operating the mine. During this period, a mill was built adjacent to the Sonnemann adit. Between 1950 and 1955, the mine was operated with poor results. Higher silver prices in 1977 sparked additional work to develop ore and reopen the mine. Currently, L. Heagney of Spartanburg, South Carolina owns all of the patented claims (17) within the South Mountain Mining District. According to Henderson (2002), the three-tiered tailings pile is not located on the patent claim, but on land managed by the BLM.

2.3 SITE OPERATIONS AND WASTE CHARACTERISTICS

The mineral deposits in the Sonnemann Mine consist chiefly of lead, zinc, silver and copper with an appreciable amount of gold (Sorenson, 1927). Sulfide ore appears to have been the primarily mined and processed from the Sonnemann Mine. Historical records lack detail, but it is believed the majority of estimated $1.67 million recovered from the South Mountain claims between 1940 and 1945 were extracted from Golconda Group of mines, including the Sonnemann Mine. Operations between 1950 and 1955 only yielded an estimated $120,000 (ISHS, 1996). The primary minerals encountered within the Golconda Group were tetrahedrite, galena, hedenbergite-ilvaite, sphalerite, chalcopyrite, arsenopyrite, pyrite, calcite and quartz. Secondary enrichment minerals include bornite, covellite and chalcocite (Sorenson, 1927).

The main adit and mill are located immediately east of Williams Creek at an estimated elevation of 6,850 feet above mean sea level (amsl). It is unknown whether all of the ore processed by the mill was removed from the Sonnemann Mine or if other mines within the district (i.e., the Texas Mine) contributed to the mill's production.

The only previous known fieldwork at the Sonnemann was conducted by the Idaho Geological Survey (Bennett et al, 2000). Sediment sampled from the tailings impoundment showed a "significant tendency for leaching...[from] arsenic, cadmium, chromium, mercury, and selenium" (ibid. p.117). Water samples from adit discharge showed exceedances of the state primary maximum contaminant level for arsenic, the state aquatic life chronic standard for lead, both state aquatic life standards for zinc, and all state standards for cadmium and mercury (ibid.).

Additional samples were collected by DEQ at the time of the PA including upstream (background), downstream, and adit water samples and a soil sample from the mine dump. Samples were not collected from the aforementioned tailings impoundment.

2.4 DEQ ACTIONS

DEQ conducted a site visit on July 2, 2002. The owner of the property, L. Heagney, was not present during the site visit. The site was not fenced and was easily accessible from the adjacent South Mountain Road. Site features included an adit, mill foundations, waste rock piles, a tailings impoundment, a row of sheds that reflects an earlier period of construction, a metal maintenance shop with a concrete slab floor and a shed on the hillside east of the entrance (Figures 2-2 and 2-3, Photo Mvc-844).

Mvc-844
Main entrance, wooden sheds (left), metal maintenance building (right)

All of the structures show evidence of vandalism, but the maintenance shop and hillside shed (not pictured) appear serviceable. The southeast-driven adit has a timbered portal, is covered with plywood sheets and is blocked by a locked gate (Photo Mvc-846).

Mvc-846
"Danger Keep Out" sign is posted on the portal

The adit, discharging water at an estimated rate of 90-100 gallons per minute, flows across the dump through the mill area below the portal and into Williams Creek (Photos Mvc-845 and Mvc-852). The remains of a collapsed ore chute and narrow-gauge rails rest on the portal-level bench above the mill.

Mvc-845
From top of collapsed ore chute,
adit drainage to Williams Creek (bushes)

Mvc-852
Ore chute debris (left),
adit drainage (background center)

On the lower bench, the foundation walls are all that remain of the mill buildings. Waste rock and what appears to be usable ore have been deposited across the mill site (Photo Mvc-847).

Mvc-847
Mill Foundation

The waste rock/ore was disposed within the mill foundations and in the dump, which measures at least 450 feet in length, 75 feet in width and 50 feet in thickness. The workings appear to parallel a faulted carbonate (limestone/marble) alteration zone that intersects the Cretaceous granodiorite host rock, similar to the Bay State Group. Sulfide minerals (chalcopyrite, arsenopyrite, pyrrhotite, marcasite, pyrite, galena and sphalerite) along with limonite and iron staining were identified on the waste/ore dump.

An old berm located along the base of the mill ruins extends to the creek and is evident on the western side of the Williams Creek Road. At some point, this berm was constructed to dam Williams Creek, possibly to supply the Sonnemann Mill with water or to support the Queen of the Mountains Mine, located due west from the Sonnemann adit. It appears the dam was demolished during construction of the bisecting Williams Creek Road. Remnants of the dam are scattered down the drainage.

A three-tiered tailings pile or impoundment, located at the northern perimeter of the site, lies adjacent to a westward flowing tributary drainage. The tailings impoundment appears to have been employed in three stages (Photo Mvc-839).

Mvc-839
3-Tier Tailings Pile

The fine texture of the tails coupled with discarded piping suggests emplacement was accomplished via slurry, possibly from a flotation milling process (Photo Mvc-851).

Mvc-851
View to south, slurry piping (?) in foreground

Along the southwest portion of the bottom tier, a crusty salt-like precipitate has formed (Photo Mvc-849). The impoundment was contained with boards and a berm along the north side of the tailings. The top tier measures at least 175 feet in length, 60 feet in width, and 20 feet in thickness; the middle tier measures at least 200 feet in length, 45 feet in width, and 10 feet in thickness; and the bottom tier measures at least 75 feet in length, 75 feet in width, and 3 feet in thickness.

Mvc-849
Upper tier (foreground), middle tier (center), and white precipitate on lowest tier.

The Williams Creek floodplain and associated wetlands extend into the bottom tier; an unnamed creek appears to be incising the northern portion of the impoundment. Evidence of channeling (blowout) of the top tier suggests historic erosion of the impoundment by tributary drainage from the east (Photo Mvc-850).

Mvc-850
Channeling of upper tier in foreground (right)

FIGURE 2-2

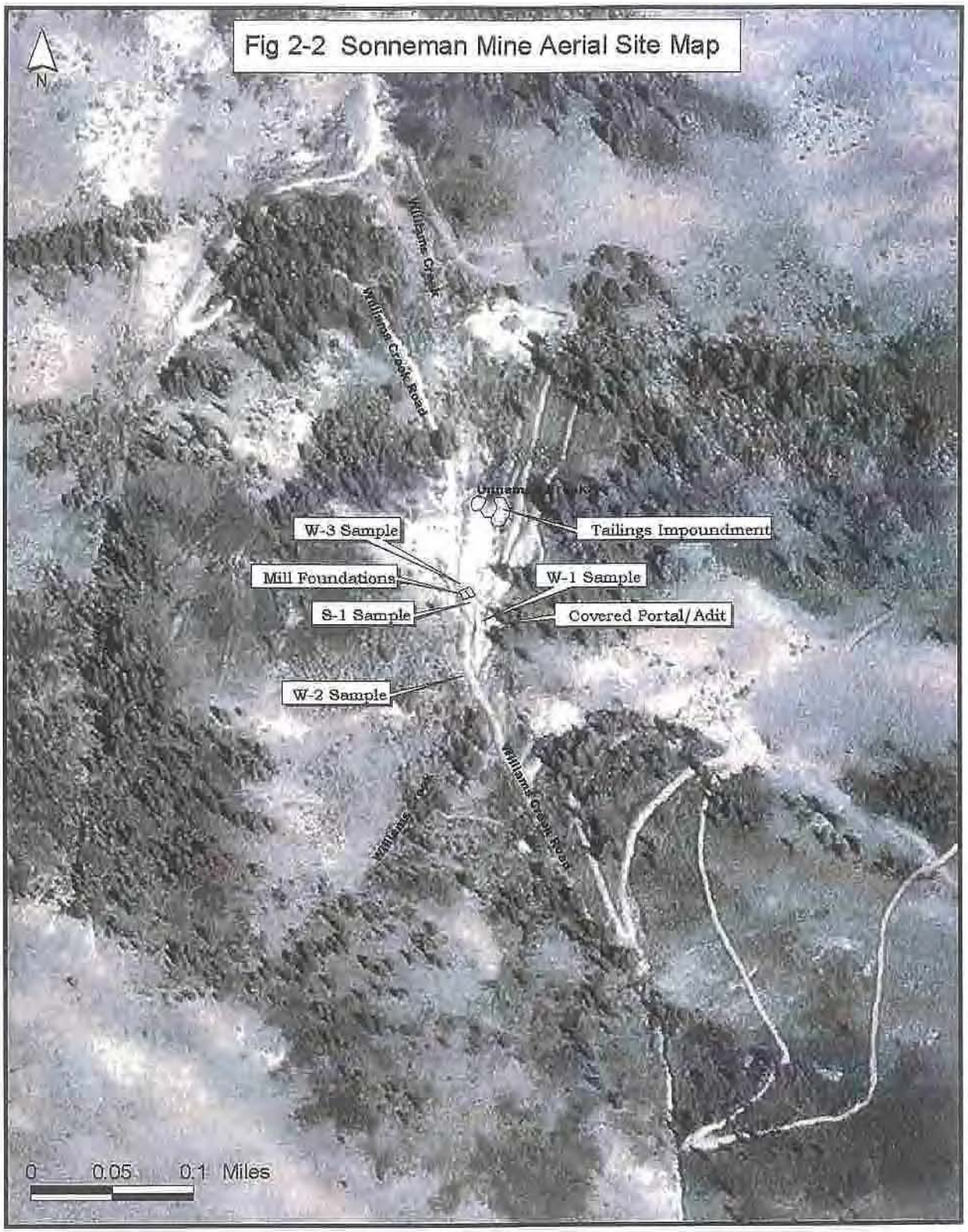
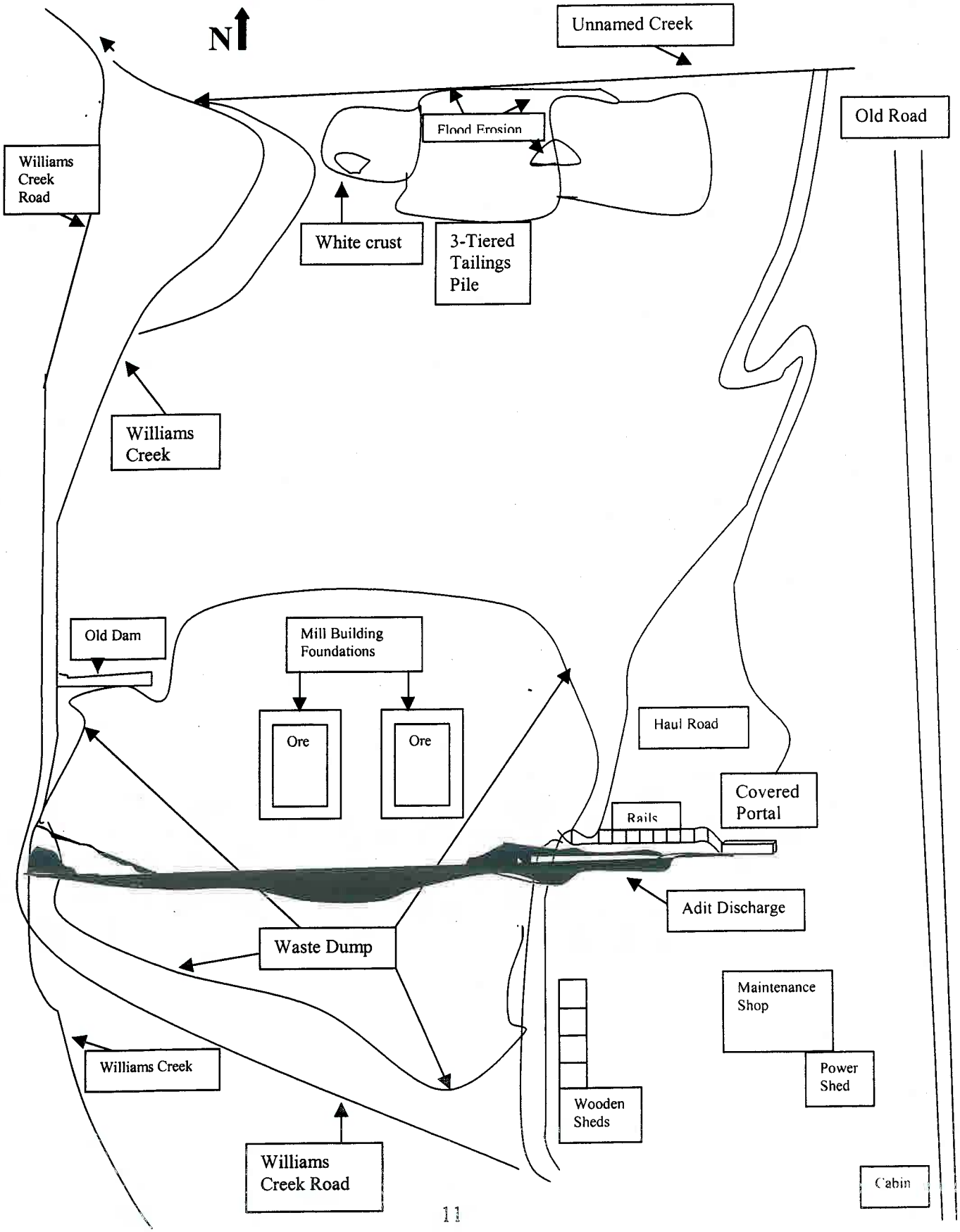


Fig 2-2 Sonneman Mine Aerial Site Map
N
Williams Creek
Williams Creek Road
W-3 Sample
Tailings Impoundment
Mill Foundations
W-1 Sample
S-1 Sample
Covered Portal/Adit
W-2 Sample
Williams Creek
Williams Creek Road
0 0.05 0.1 Miles

SITE MAP
FIGURE 2-3



3. MIGRATION/EXPOSURE PATHWAYS AND TARGETS

The following sections describe migration/exposure pathways and potential targets within the site's range of influence (Figures 3-1 and 3-2).

3.1 GROUND WATER MIGRATION PATHWAY

South Mountain has been described as a continuation of the Owyhee Range (Lindgren, 1900) and an isolated uplift (Bell, 1906). Sorenson (1927) stated the South Mountain uplift bears no direct connection to the Owyhee range. The highest summits of the South Mountain Range seem to follow the strike of the metamorphosed sediments while the long axis of the range strikes in a northwest-southeast direction and parallels the Owyhee Range. South Mountain measures 15 miles northwest-southeast with a width of approximately 10 miles. The elevation of South Mountain is 7,801 feet while Jordan Valley, Oregon, which lies in the valley to the north, has an elevation of 4,200 feet. The regional relief is about 3,400 feet. South Mountain's topography is similar to the Silver City area. Streams with steep gradients and hills with steep slopes are common, but summits tend to be rounded. Williams, Mill, South Mountain and Willow Creeks drain the north slopes of South Mountain. Williams Creek, which heads about 200 feet vertically and 500 feet horizontally from South Mountain, is a permanent stream from its source to its end during all seasons (ibid.).

The stratified rocks of South Mountain are largely metamorphosed sediments. Lindgren (1900) mapped the South Mountain sediments as Carboniferous age and correlated them with the Seven Devils series from an outcrop exposed near Huntington, Oregon, 115 miles to the north. The metasediments are composed of "more than 4,000 feet of garnetiferous-quartz-mica schist, fine-grained quartzite, and marble, which were tightly folded and later intruded and surrounded by a grano-diorite-quartz-monzonite magma" (ibid. p.10). Intrusion of granitic magma created extensive contact metamorphism throughout the South Mountain Mining District and appears to correlate to the sediments of the Flynt Mining District to the north (Piper and Laney, 1926).

The constituent sediments of South Mountain were probably metamorphosed during the upper Jurassic lower Cretaceous period with the intrusion of granodiorite. Subsequent erosion of the metasediments and granodiorite enabled outpouring of Miocene flood basalts (Christiansen and Lipman, 1970). Following deposition of basalts, the area was again subjected to uplift. The present topography resulted from glaciation and stream erosion. Cirques were developed only on the north side of South Mountain. The streams, including Williams Creek, are reworking the glacial debris (Sorenson, 1927).

Ground water exists locally within fractures in the bedrock and within the unconsolidated deposits. Several springs are located within 0.75 miles upgradient from the mine. As evident at the Sonnemann portal, ground water also surfaces through adit drainage.

No precipitation data is available for the Sonnemann Mine or South Mountain. Silver City, located 20 miles north and comparable in elevation to this site, maintained data from 1978

to 2000. The mean annual precipitation for this period was 21.76 inches, the mean annual snowfall was 87.9 inches and the maximum 24-hour precipitation event was 2.75 inches (WRCC, 2002).

There are not any drinking water or irrigation wells located within the 4-mile Target Distance Limit (TDL). The site is not located within a wellhead protection area (DEQ, 2002).

3.2 AIR MIGRATION PATHWAY

The nearest residence to the Sonnemann Mine is 7 miles north of the site. A Bureau of Land Management (BLM) lookout tower at the summit of South Mountain, located 1.5 miles south, is manned by one individual during the annual June to October fire season.

The site is comprised of unconsolidated ore and/or waste rock (varying in degree of compaction) and fine-grained tailings deposits. The ore and/or waste rock, located within the mill building foundation, emitted an acrid sulfur odor when disturbed. Though fine-grained in size, the tailings exhibited strong binding characteristics and the surface appeared "gummy" to contact. The likelihood of aerial dispersal from the tailings impoundment appears remote.

3.3 SOIL EXPOSURE PATHWAY

Access to the Sonnemann Mine is unrestricted. Williams Creek Road is maintained during the fire season to allow ready access to the BLM lookout tower on South Mountain. Evidence of fire pit (likely from a hunting camp), abundant signs of cattle activity and vandalism to structures illustrates the ease of access to this site. There are no workers or residences within 200 feet of the site. The nearest residence is 7 miles north of the site. A BLM lookout tower at the summit of South Mountain, located 1.5 miles south, is manned by one individual during the fire season (June through October). No schools or day-care facilities are located within 200 feet of the site.

Ore and/or waste rock (sulfide-rich) are piled in close proximity to the portal, within the foundations of the old mill and scattered along the haul road to the three-tiered tailings impoundment. DEQ collected a representative sample from the waste dump (Appendix B). Total metals analysis of the dump sample indicates risk levels of barium, cadmium, chromium, mercury, selenium and silver are below 1 x E -6 (or 1 in 1,000,000), conservatively assuming an industrial exposure scenario. Using the same exposure scenario, risk from arsenic is approximately 3.27 x E-4, and lead is approximately 5.6 x E-5 (EPA[1], 2002).

The tailings are fine-grained, appear gummy to the touch and exhibit a white crusty precipitate on the surface of the lowest tier immediately adjacent to Williams Creek. At the time of the site visit DEQ was unable to sample the tailings pile.

3.4 SURFACE WATER MIGRATION PATHWAY

The site slopes north and northwest toward Williams Creek. An unnamed westerly flowing tributary delineates the northern boundary of the site. The unnamed creek, which flows directly into Williams Creek, appears to be incising the tailings impoundment. Evidence of channeling across the top tier suggests historic erosion of the impoundment by the unnamed creek.

At the time of the site visit, water was observed flowing from the adit at 90-100 gallons per minute across the dump and into Williams Creek (Photo Mvc-845). One Probable Point of Entry (PPE), adit drainage, is located approximately 100 feet west-northwest from the portal into Williams Creek.

Mvc-845
From top of collapsed ore chute, adit drainage to Williams Creek (bushes)

A second PPE, erosion of the tailings impoundment, is tailings washing into the unnamed creek. Though not observed, a third PPE, is overland flow from runon/runoff across the site into Williams Creek.

During the site visit, DEQ collected three water samples: directly from the adit at the portal; in Williams Creek immediately downstream from the aforementioned first PPE; and upstream of the Sonnemann Mine to establish background (Appendix B). Analyte concentrations in the upstream sample are all non-detect, therefore, increased metal concentrations downstream of the PPE from the adit is attributable to the mine. Concentrations of arsenic, cadmium and lead observed in the adit water sample appear diluted, but retain a distinctive signature in Williams Creek. The pH of the downstream sample from the PPE is lower (0.10) than from the upstream background sample.

Water sampled from the adit shows concentrations of arsenic (50 µg/kg) equal to the Maximum Concentration Limit (MCL), but the risk is calculated at 1.1 x E-3 (EPA[1], 2002). The risk from arsenic downstream from the PPE is calculated at 5.8 x E-4 and is approximately equal to one-half of the MCL. The lead concentrations of both adit and downstream samples are approximately one-third of the MCL (0.015) as presented in EPA's current Drinking Water Standard (EPA[2], 2002).

Soil survey data for the site is unavailable, but Sorenson (1927) suggests glacial till is an integral component. Direct observation revealed a coarse-grained sandy loam underlain by characteristic glacial debris. Based upon observation during the site visit, moderate infiltration rates would be expected.

The maximum 24-hour rainfall event for Silver City was 2.75 inches (WRCC, 2002). From its amphitheater-like headwater basin, Williams Creek cuts a steep gradient between steep sloped hills as it passes the site. The unnamed creek, located on the northern perimeter of the site, has flooded portions of the tailings impoundment. Based upon the topography, climate, and observations at the site, the potential for flooding would appear to be moderate.

There are no drinking water intakes within the TDL. Traversing north, the surface water pathway is enjoined by several unnamed creeks before West Creek merges at 6.25 miles, Pole Bridge Creek merges at 7.75 miles, and it flows into Jordan Creek at 10 miles from the site. Jordan Creek continues within the 15-mile TDL for another 5 miles to the northwest. Jordan Creek is listed by DEQ as a §303(d) stream meeting a total maximum daily load for pesticides, oil and grease, bacteria, sediment and metals; however, metals are not listed as a pollutant after the confluence of Jordan Creek and Williams Creek.

Commercial and subsistence fishing are not conducted within the surface water TDL. Sport fishing was observed in Williams Creek between the old townsite of South Mountain (0.5 miles north of site) and West Creek. Fish catch data, however, could not be determined.

One plant species, listed as sensitive (F&G, 2002), was identified at four locations within a 4-mile radius of the Sonnemann Mine. The Least Phacelia (common name), Phacelia Minutissima, was identified at sites 0.60 miles and 1.30 miles southeast, 1.45 miles south, and 2 miles southeast from the Site. One threatened species was identified within a 4-mile radius of the Mine. The Western Toad (common name), Bufo Boreas, was identified 3.5 miles north along Williams Creek (USDA Forest Service, 1994). According to the U.S. Fish and Wildlife Service (2002), there are no wetlands inventoried within the TDL.

It is expected the surface water be used for crop irrigation and by livestock and wildlife for drinking water. The high volume, perennial discharge from the adit and evidence of flooding into and through the tailings impoundment illustrates releases from the site to the surface water TDL are assured.

Fig 3-1 Sonneman Mine 4-Mile Radius Map

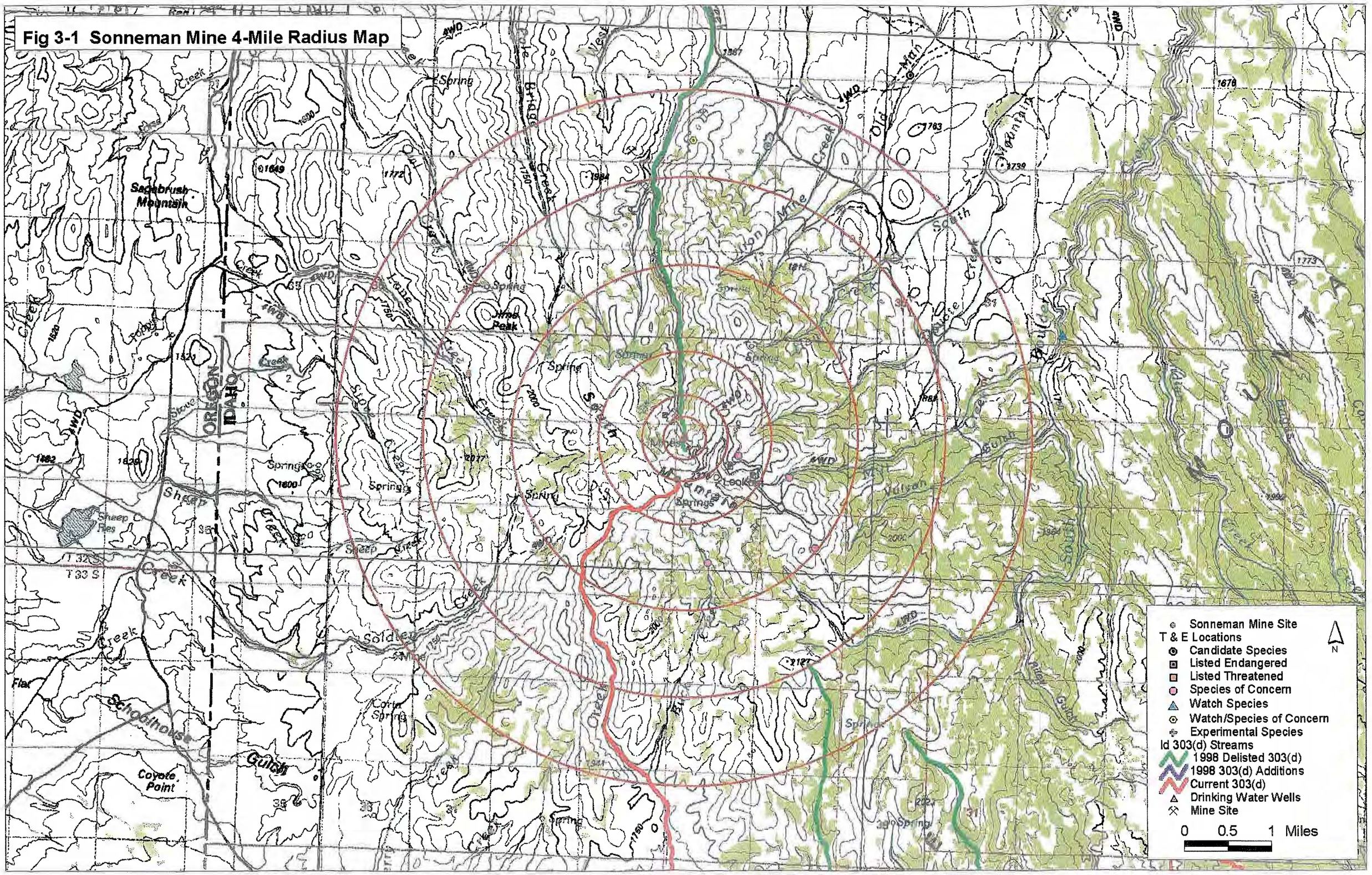


FIGURE 3-2

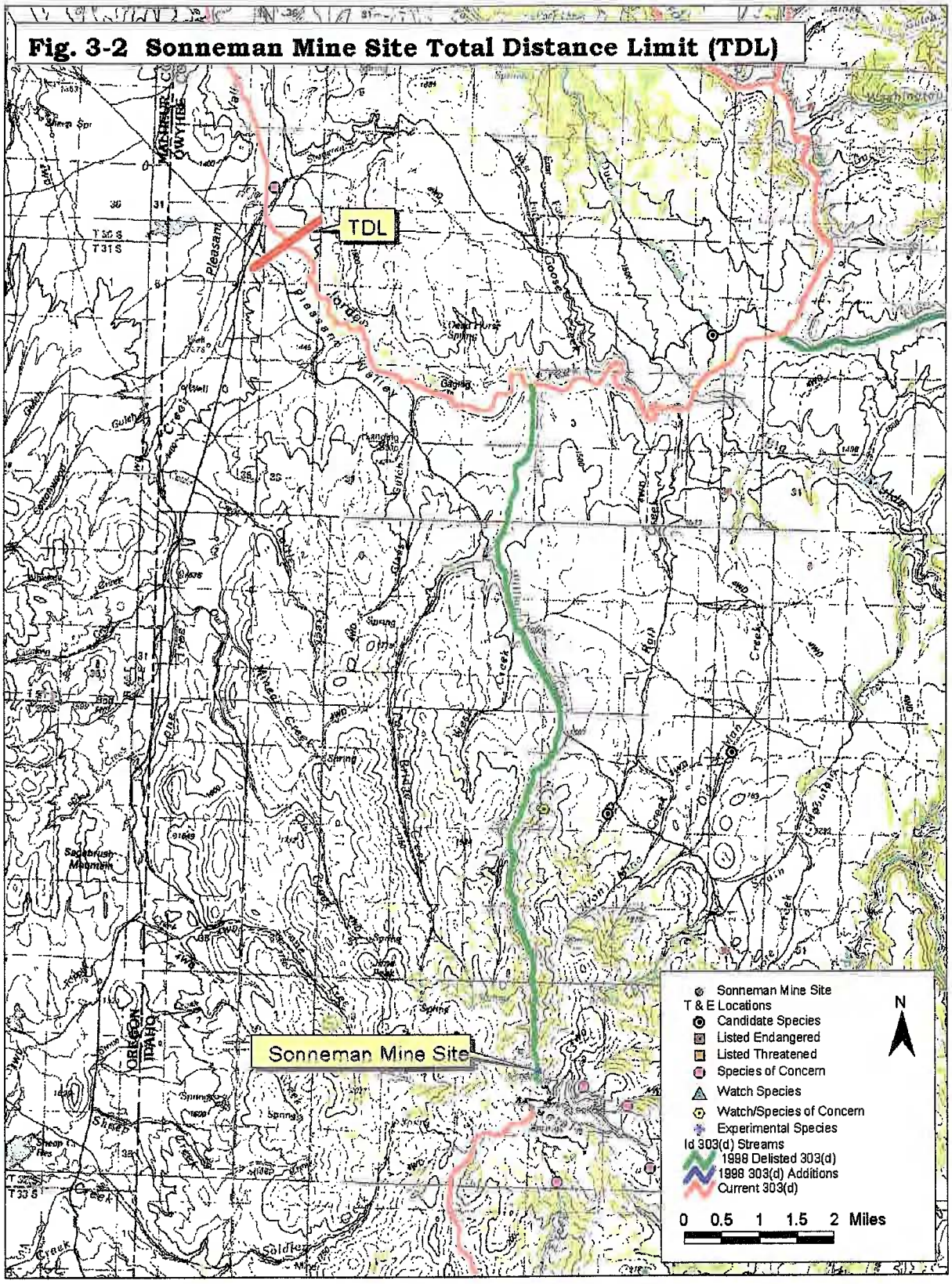


Fig. 3-2 Sonneman Mine Site Total Distance Limit (TDL)
TDL
Sonneman Mine Site
Sonneman Mine Site
T & E Locations
Candidate Species
Listed Endangered
Listed Threatened
Species of Concern
Watch Species
Watch/Species of Concern
Experimental Species
Id 303(d) Streams
1998 Delisted 303(d)
1998 303(d) Additions
Current 303(d)
N
0 0.5 1 1.5 2 Miles

REFERENCES

Bell, R. N., 1906, South Mountain Mine: manuscript report (Initial report, 1906, additional data, 1907). Boise, Idaho.

Bennett, E.H., J.D. Kauffman, and V.E. Mitchell, 2000. Site Inspection Report for the Abandoned and Inactive Mines in Southern Idaho, Owyhee County: Volume II: Flint Creek-South Mountain Areas, Owyhee County, Idaho: Report Prepared for the U.S. Environmental Protection Agency, Idaho Operations Office.

Christiansen, R. I., P.W. Lipman, 1970. Cenozoic Volcanism and Tectonism in the western U.S. and adjacent parts of the spreading ocean floors, Part 2: GSA Abstracts with Program, V. 2, pp. 81-82.

DEQ (Department of Environmental Quality), 2002, Personal Communication from R. Taylor, Technical Services Division.

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

EPA[1] (U.S. Environmental Protection Agency), Region 9 Preliminary Remediation Goals, http://www.epa.gov/region09/waste/sfund/prg/files/02table.pdf

EPA[2] (U.S. Environmental Protection Agency)
http://www.epa.gov/safewater/mcl.html

Henderson, K., Personal Communication, 2002.

ISHS (Idaho State Historical Society), 1996. Reference Series, South Mountain, Number 564.

Jennings, V.P., Unpublished Manuscript, History of Mining in Idaho: U.S. Geological Survey.

Lindgren, W, 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. 3.

Piper, A.M. and F.B. Laney, 1926. Geology and Metalliferous Resources of the Region about Silver City, Idaho: Idaho Bureau of Mines and Geology, Bulletin. 11.

Sorenson, R.E, 1927, The Geology and Ore Deposits of the South Mountain Mining District, Owyhee County, Idaho, Idaho Bureau of Mines and Geology, Moscow, Idaho.

United States Fish and Wildlife Service, 2002.
http://wetlands.fws.gov/

USDA Forest Service (U. S. Department of Agriculture), April 1994, Janet Sullivan,
http://www.fs.fed.us/database/feis/animals/amphibian/bubo/introductory.html

WRCC (Western Regional Climate Center), 2002.
http://www.wrcc.dri.edu/htmlfiles/id/id.ppt.ext.html

Sorenson, R. E., 1927. The Geology and Ore Deposits of the South Mountain Mining District, Owyhee County, Idaho: Idaho Bureau of Mines and Geology, Moscow, Idaho.

United States Fish and Wildlife Service, 2002.
http://wetlands.fws.gov/

USDA Forest Service (U. S. Department of Agriculture), April 1994, Janet Sullivan,
http://www.fs.fed.us/database/feis/animals/amphibian/bubo/introductory.html

WRCC (Western Regional Climate Center), 2002.
http://www.wrcc.dri.edu/htmlfiles/id/id.ppt.ext.html

APPENDIX A

PHOTO LOG
SONNEMANN MINE AND MILL

Mvc-839	View to east, from top of Upper Bay State Tunnel Dump. Upper and middle tiers of tailings impoundment, thickness of tiers delineated.
Mvc-844	View to north, of main entrance to Sonnemann facility. Older wooden sheds (lab?) on left, newer metal maintenance building on right. Adit drainage faintly visible just beyond shadow of maintenance building roof, adjacent to ore chute at center of photo.
Mvc-845	View to west, from top of collapsed ore chute, overland flow of adit drainage across tailings into Williams Creek.
Mvc-846	View to east, into adit, warning sign ("Danger Keep Out") above wood covered portal, locked gate in background (barely visible - flash not working).
Mvc-847	View to north, panoramic across mill ruins to tailing pile (barren area beyond brush), white areas along western side of tailings appears to be leached salts.
Mvc-848	View to northwest, from top of collapsed ore chute, across mill ruins to Williams Creek (covered by bushes) lies between Williams Creek Road and mill. Ore stockpiles (sulfide minerals, copper, lead, zinc) were placed within foundation walls but have overflowed to the creek. Tailings pile shown in background.
Mvc-849	View to west, from top tier of tailings pile, foreground shows evidence of blowout style erosion to the creek beyond. "Salt" deposits shown on lowest tier of tailings in background. Williams Creek meanders to the edge of this tier near the salt accumulation.
Mvc-850	View to south, from tailings pile towards mill ruins. Mill foundation wall (dark rectangle) adjacent to ore stockpiles and Williams Creek Road in background. Immediate foreground shows blowout erosion of tailings.
Mvc-851	View to south, across site, slurry pipe (?) in foreground on middle tier of tailings, ore stockpiles and mine buildings at center, Williams Creek Road in background.
Mvc-852	View to southwest, collapsed ore chute on left, mine drainage at center, Williams Creek Road in background.

APPENDIX B

ANALYTICAL DATA

IDAHO DEPARTMENT OF HEALTH & WELFARE

DIRK KEMPTHORNE – Governor
KARL B. KURTZ – Director

RECEIVED

JUL 24 2002

DEPT. OF ENVIRONMENTAL QUALITY
TECHNICAL SERVICES OFFICE

BUREAU OF LABORATORIES
RICHARD F. HUDSON, Ph.D., Chief
2220 Old Penitentiary Road
Boise, ID 83712
PHONE 208-334-2235
FAX 208-334-2382

Attention: Brian Gaber
Dept. of Env. Quality - Boise Regional Office
1445 N. Orchard Street
Boise, ID 83706-2239

Date Collected: 7/2/2002
Time Collected: 12:50 PM
Date/Time Received: 7/3/2002 2:06:27 PM

Lab Sample ID Number
02 07 096
(Please refer to this number when contacting the lab)

DEQB / 4814

Site: Tailings

Collected By: Brian Gaber

Matrix: Soil

Sample ID: S1

Type / Source:

Test	Method	Result	Units	Date Completed	Analyst
Arsenic, Total	EPA 7060A	523	mg/Kg	7/19/2002	huangh
Duplicate sample = 525 mg/kg					
Cadmium, Total	EPA 7130	80.2	mg/kg	7/17/2002	stranskyj
Duplicate sample = 65.5 mg/kg Spike recover = 111 %					
Chromium, Total	SM 3111D	<15	mg/kg	7/17/2002	stranskyj
Duplicate sample = <15 mg/kg Spike recovery = 112 %					
Lead, Total	EPA 7420	42 442	mg/kg	7/17/2002	stranskyj
Replicate samples = 556 mg/kg and 658 mg/kg. It is common for Pb analyses. Pb is not distributed evenly in soil samples.					
Mercury, Total	EPA 7471A	<0.25	mg/Kg	7/16/2002	stranskyj
Duplicate sample = <0.25 mg/kg. Spike recovery = 108 %					
pH	EPA 150.1	8.27	pH Units	7/5/2002	alvesb
Selenium, Total	EPA 7740	<10	mg/Kg	7/19/2002	huangh
Duplicate sample < 10 mg/kg . Spike recovery = 96 %					

Memo: Sample is not homogenous (contains bigger and smaller rocks). Analysis was done on fine material only).

Reported: Monday, July 22, 2002

EPA Laboratory ID: ID00018

Laboratory Supervisor

IDAHO DEPARTMENT OF HEALTH & WELFARE

DIRK KEMPTHORNE - Governor
KARL B. KURTZ - Director

RICHARD H. SCHULTZ - Administrator
DIVISION OF HEALTH
BUREAU OF LABORATORIES
2220 Old Penitentiary Road
Boise, ID 83712
PHONE 208-334-2235

Dept. of Env. Quality - Boise Regional Office
1445 N. Orchard Street

Boise, ID 83706-2239
Attention: Brian Gaber

Date Collected: 7/2/2002
Time Collected: 12:05 PM
Date/Time Received: 7/3/2002 2:06:27 PM

Lab Sample ID Number
02 07 093
(Please refer to this number when contacting the lab)

DEQB / 4814
Site: Adit
Collected By: Brian Gaber
Sample ID: W1

Matrix: Surface Water
Type / Source:

Test	Method	Result	Units	Date Completed	Analyst
Arsenic, Total	EPA 200.9	0.050	mg/L	7/19/2002	huangh
Cadmium, Total	EPA 200.9	0.018	mg/L	7/18/2002	stranskyj
Chromium, Total	EPA 200.7	<0.005	mg/L	7/19/2002	stranskyj
Lead, Total	EPA 200.9	0.005	mg/L	7/18/2002	stranskyj
Mercury, Total	EPA 245.1	<0.0005	mg/L	7/16/2002	stranskyj
pH	EPA 150.1	8.11	pH Units	7/5/2002	alvesb
Selenium, Total	EPA 200.9	<0.01	mg/L	7/19/2002	huangh

Reported: Monday, July 22, 2002

EPA Laboratory ID: ID00018

Laboratory Supervisor

IDAHO DEPARTMENT OF HEALTH & WELFARE

DIRK KEMPTHORNE - Governor
KARL B. KURTZ - Director

RICHARD H. SCHULTZ - Administrator
DIVISION OF HEALTH
BUREAU OF LABORATORIES
2220 Old Penitentiary Road
Boise, ID 83712
PHONE 208-334-2235

Dept. of Env. Quality - Boise Regional Office
1445 N. Orchard Street

Boise, ID 83706-2239
Attention: Brian Gaber

Date Collected: 7/2/2002
Time Collected: 12:20 PM
Date/Time Received: 7/3/2002 2:06:27 PM

Lab Sample ID Number

02 07 095

(Please refer to this number when contacting the lab)

DEQB / 4814

Site: Down Stream Williams Cr.

Collected By: Brian Gaber

Matrix: Surface Water

Sample ID: W3

Type / Source:

Test	Method	Result	Units	Date Completed	Analyst
Arsenic, Total	EPA 200.9	0.026	mg/L	7/19/2002	huangh
Cadmium, Total	EPA 200.9	0.007	mg/L	7/18/2002	stranskyj
Chromium, Total	EPA 200.7	<0.005	mg/L	7/19/2002	stranskyj
Lead, Total	EPA 200.9	0.005	mg/L	7/18/2002	stranskyj
Mercury, Total	EPA 245.1	<0.0005	mg/L	7/16/2002	stranskyj
pH	EPA 150.1	8.09	pH Units	7/5/2002	alvesb
Selenium, Total	EPA 200.9	<0.01	mg/L	7/19/2002	huangh

Reported: Monday, July 22, 2002

EPA Laboratory ID: ID00018

Laboratory Supervisor

IDAHO DEPARTMENT OF
HEALTH & WELFARE

DIRK KEMPTHORNE - Governor
KARL B. KURTZ - Director

RICHARD H. SCHULTZ - Administrator
DIVISION OF HEALTH
BUREAU OF LABORATORIES
2220 Old Penitentiary Road
Boise, ID 83712
PHONE 208-334-2235

Dept. of Env. Quality - Boise Regional Office
1445 N. Orchard Street

Boise, ID 83706-2239
Attention: Brian Gaber

Date Collected: 7/2/2002
Time Collected: 12:10 PM
Date/Time Received: 7/3/2002 2:06:27 PM

Lab Sample ID Number
02 07 094
(Please refer to this number when contacting the lab)

DEQB / 4814
Site: Up Stream Williams Cr
Collected By: Brian Gaber
Sample ID: W2

Matrix: Surface Water
Type / Source:

Test	Method	Result	Units	Date Completed	Analyst
Arsenic, Total	EPA 200.9	<0.005	mg/L	7/19/2002	huangh
Cadmium, Total	EPA 200.9	<0.001	mg/L	7/18/2002	stranskyj
Chromium, Total	EPA 200.7	<0.005	mg/L	7/19/2002	stranskyj
Lead, Total	EPA 200.9	<0.005	mg/L	7/18/2002	stranskyj
Mercury, Total	EPA 245.1	<0.0005	mg/L	7/16/2002	stranskyj
pH	EPA 150.1	8.20	pH Units	7/5/2002	alvesb
Selenium, Total	EPA 200.9	<0.01	mg/L	7/19/2002	huangh

Reported: Monday, July 22, 2002

EPA Laboratory ID: ID00018

Laboratory Supervisor