Consolidated Mine
Preliminary Assessment Report

Bear Lake County
State of Idaho

Department of Environmental Quality

September 2007

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

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List of Acronyms

Acronym	Definition
bgs	below ground surface
BLM	U.S. Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DEQ	Idaho Department of Environmental Quality
EPA	United States Environmental Protection Agency
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IDWR	Idaho Department of Water Resources
PA	Preliminary Assessment
SDWIS	Safe Drinking Water Information System
TDL	Target Distance Limit
USFS	United States Forest Service
USGS	US Geological Survey
USPCM	United States Phosphate Company of Michigan

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Section 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 preliminary assessments at various mines within Idaho.

The DEQ often receives complaints or information about sites that may be contaminated with hazardous waste. These sites can include abandoned mines, rural airfields that have served as bases for aerial spraying, old landfills, illegal dumps, and abandoned industrial facilities that have known or suspected releases.

In February 2002, DEQ initiated a Preliminary Assessment Program (DEQ, 2004a) to evaluate and prioritize assessment of such potentially contaminated sites. Due to accessibility and funding considerations, priority is given to sites where potential contamination poses the most substantial threat to human health or the environment.

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

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

This report presents the results of the preliminary assessment (PA) of the Consolidated Mine and also documents the interagency preliminary assessment and risk screening activities conducted for this *orphan mine site* located within the boundaries of the *Southeast Idaho Phosphate Mining Resource Area* (Figure 1; the green border outlines the resource area). The report was prepared by the Idaho Department of Environmental Quality (DEQ), in collaboration with the United States Bureau of Land Management (BLM), the United States Forest Service (USFS), and the Idaho Department of Lands (IDL)—the primary mining administration agencies in southeast Idaho.

Site descriptions, conditions, data, and photos are taken directly from the *Orphan Mine Site Preliminary Assessment Screening Report* published in 2004 (DEQ, 2004a). Recommendations from the earlier report have been expanded upon in this report, based on DEQ evaluation of the earlier screening report.

1.1 Background of the Inactive Mine Assessments

Orphan mine sites consist of those historic mining operations not previously scheduled for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site-specific investigations conducted under the ongoing selenium investigation activities (DEQ, 2007). This PA was conducted to ensure all historic mining sites within the Idaho Phosphate Mining Resource Area have been inspected and evaluated in accordance with the goals and objectives outlined in the *Area Wide Risk Management Plan* (DEQ, 2004b):

- Protecting southeast Idaho's surface water resources by reducing risks to existing aquatic life and sensitive species from selenium and related trace metal

concentrations in regional subbasins and stream segments through (a) compliance with the National Toxics Rule and State Water Quality Regulation numeric criteria (b) development and demonstration of Best Management Practices (BMPs) to prevent future mining releases and associated risks from selenium and related trace metals in receiving streams and water bodies, and (c) development of a long-term monitoring plan for regional surface water resources to ensure effectiveness of risk reduction measures.

- Protecting wildlife, habitat, and ecological resources in southeast Idaho by reducing subpopulation risks to local wildlife to acceptable levels as established by risk-based action levels and by minimizing wildlife risks through the development and demonstration of effective BMPs for future mines.
- Maintaining and protecting multiple beneficial uses of the Southeast Idaho Phosphate Mining Resource Area by reducing livestock grazing risks and associated losses from selenium exposures in forage and drinking water sources and by preventing potential future public health risks by prohibiting residential land use and development in the immediate vicinity of phosphate mining waste units and/or impacted areas.
- Protecting southeast Idaho's ground water resources by identifying, characterizing, and responding to groundwater contamination sources that may present potential public health or ecological risks and by developing and demonstrating BMPs to control future mining releases and associated risks from selenium and related trace metals in groundwater.

The earlier orphan mine site screening effort (DEQ, 2004a) included preliminary assessment activities at fourteen historic mine sites identified through lease records and literature reviews of past mining activities. Preliminary site inspections and environmental sampling of potentially impacted media (surface water, soil, sediment, and vegetation) was conducted by interagency sampling teams in May and July of 2002. Risk evaluation consisted of reviewing site data in terms of site conditions, areas of impact, potential for continued releases, and regional risk-based action levels developed for the Area Wide Risk Management Plan.

1.2 Overview

The Consolidated Mine is located in Bear Lake County, Section 8, Township 14 South, Range 43 East, approximately 2 miles west of Bloomington, Idaho (Figure 2). The site is located on private land in Little Canyon, a north branch off Bloomington Canyon about one-half mile north of Bloomington Canyon road. The former mine can be reached from Bloomington by driving east along Bloomington Creek Road, then north along Little Canyon Road.

The closest town to the site is Bloomington, Idaho, which is approximately two miles by air and four miles by road. The topography around the site is illustrated by Figure 2; Figure 3 shows the proximity of domestic and public water system wells within four miles of the site and surface water time of travel (TOT) delineations for 3, 6, and 10-year spans.

The mine area consists of one production adit, two small test adits, one exploration trench, three waste dumps, and a wooden building. An intermittent stream channel runs through the site. The stream is dry through the mine area but begins to flow about a quarter mile downstream. There is a sediment trap across the channel about 50 feet above where surface flow begins, creating a small weir across the channel capable of holding about two feet of water.

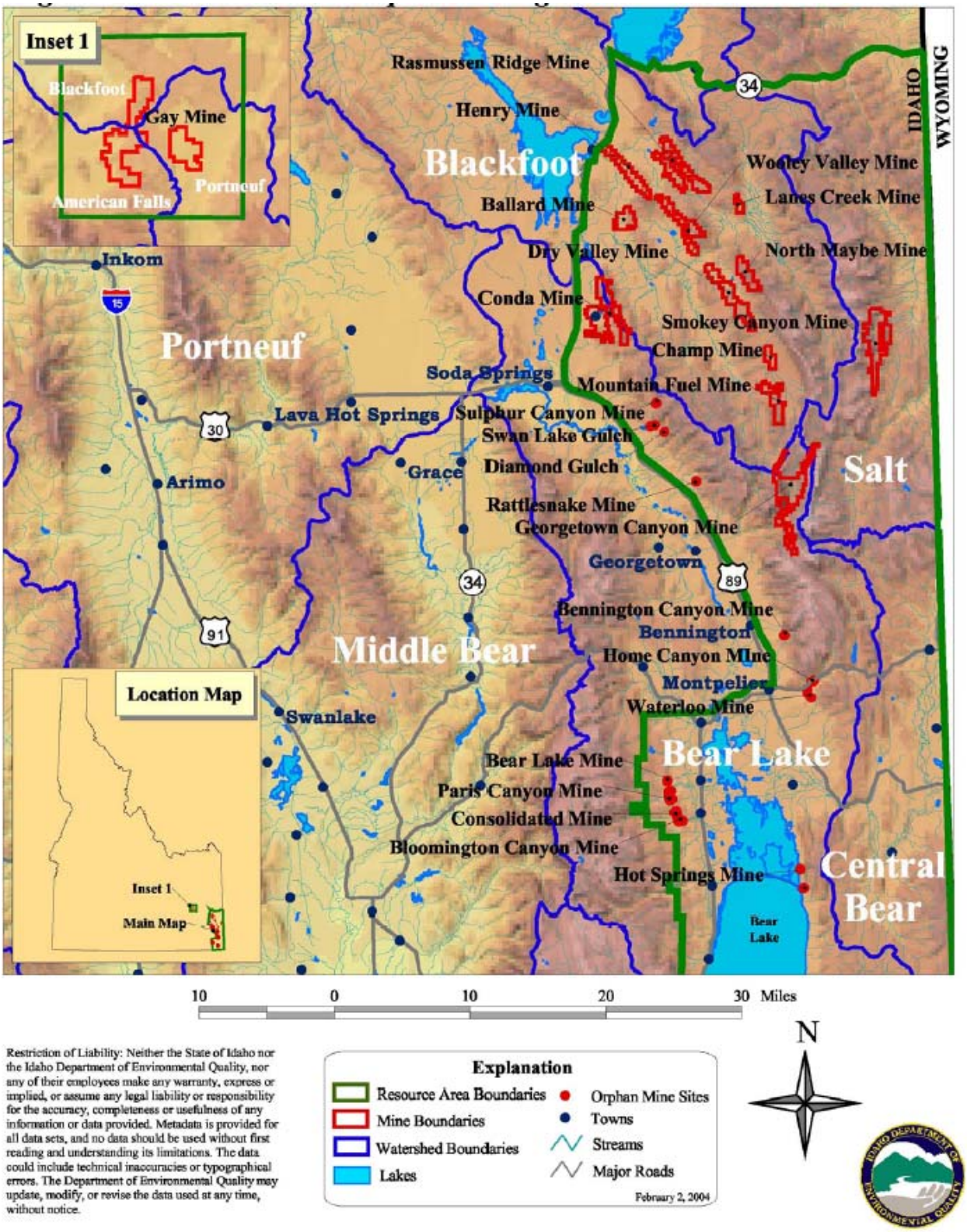


Figure 1. Location of the Consolidated Mine within the state of Idaho and delineation of the Southeast Idaho Phosphate Mining Resource Area (green boundary).

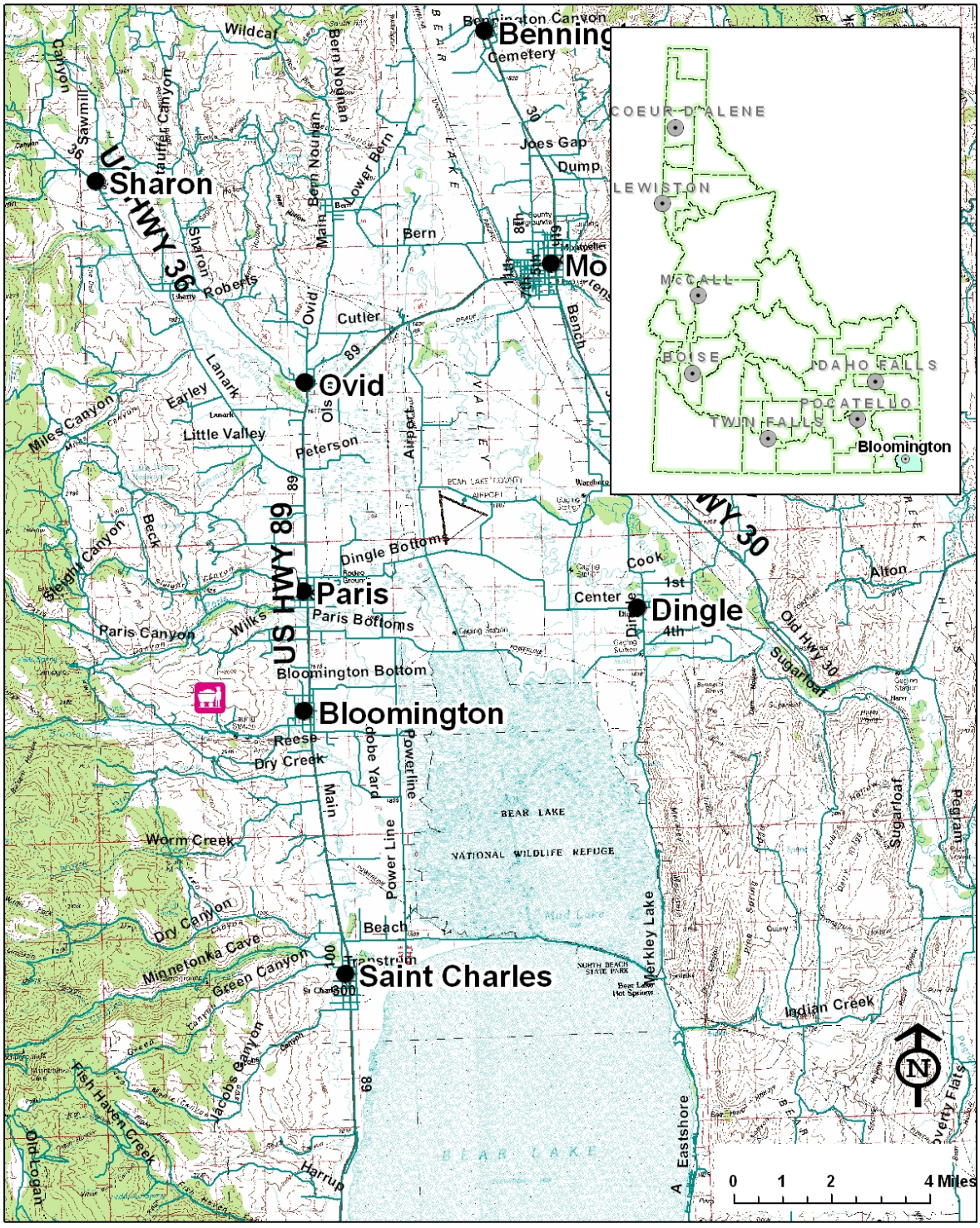


Figure 2. Topographic overview of the Consolidated Mine area.

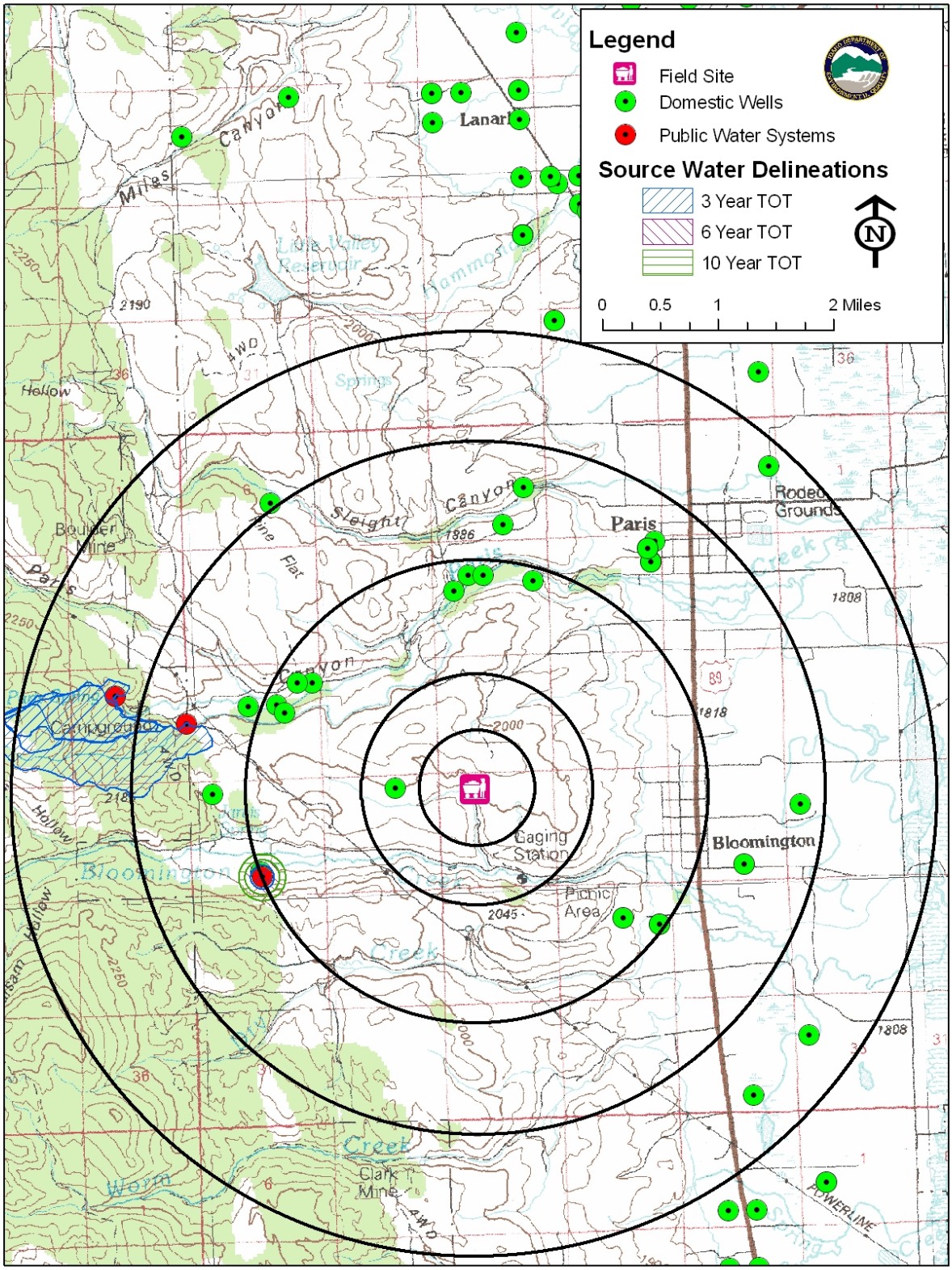


Figure 3. Domestic and Public Water System wells within a 4-mile radius.

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

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

2.1 Ownership

The Consolidated Mine property currently comprises the Star No.1, Star No. 2, and Star No. 3 patents (USGS, 2000). All three of the lode claims were located by Joseph Oakey, G. W. Nebeker, and G. Spongberg. The claimants sold the claims to the United States Phosphate Company of Michigan (USPCM), L. A. Jeffs, agent. The claims were patented by that company on July 20, 1917.

The patents were transferred by quitclaim deed, on July 31, 1922, to Francis A. Jeffs, executor of the estate of Lewis A. Jeffs, the former agent of the USPCM. In the latter part of 1930, the Solar Development Co. Ltd. acquired the property by lease and option from Francis A Jeffs.

According to the Bear Lake County Tax Assessor, the current owner of record is Earth Sciences, Inc., 8100 S. Parkway, Suite B-2, Littleton, Co. 80120.

2.2 Historical Perspective

In October 1903, Charles C. Jones and Elizabeth Jones, along with six other prospectors, located a placer mining claim on the site. The claim was soon abrogated due to inactivity, and no interest was shown in the area until 1908, when Joseph Oakley, G. W. Nebeker, and G. Spongberg explored the area for phosphate rock and located three lode claims.

In early 1915, the claims were sold to the United States Phosphate company of Michigan, and the three claims were patented in 1917. United States Phosphate unsuccessfully attempted to mine the area.

By 1930, the mine had become property of Solar Development Company, Ltd, a subsidiary of the Consolidated Mining and Smelting Co., Ltd. of British Columbia, which did extensive mining. Approximately 3,500 feet of underground workings were developed, with the ore being shipped to the Consolidated Mining Company's mill in Trail, British Columbia. The finished triple super phosphate fertilizer product was marketed under the trade name "Elephant Brand." The mine closed in early February 1932.

Data on total mine production are not available. In 1932, the inclined shaft was reported to be 200 feet deep with two intermediate lateral drifts, totaling about 3,500 feet of underground development (Campbell, 1932). It has been reported that during January and February 1932, Solar Development Company shipped about 3,500 tons of phosphate ore

to the Consolidated mill in Trail, British Columbia. That was apparently the last shipment of ore, because the mine was closed and all the equipment was removed in the early part of February 1932. The lease and option held by Solar Development was returned to Francis A. Jeffs, the property owner.

Campbell (1930) reported that Solar Development Company constructed buildings, installed mining equipment, and started sinking an inclined shaft in 1930. .

2.3 Regional Climate

Climate in southeast Idaho is influenced by major topographic features, including the Pacific Coast, and local mountain ranges. The mountains affect local wind, precipitation, and temperature patterns.

Summer temperatures in the valleys are typically dry with average maximum temperatures in the low 80's (˚F) and average minimum temperatures in low to mid 40's (˚F). Summer precipitation is usually associated with thunderstorms. Fall and winter are dominated by cold, dry continental air and by cyclonic storms. The average maximum temperatures during February are in the low 30's (˚F) with the average minimums below 10 ˚F. Most precipitation during fall and winter falls as snow accumulating in the valleys and on the surrounding mountains. Spring precipitation usually results from cool marine air flowing in from the south.

As reported by the Western Regional Climate Center (WRCC) the average annual precipitation varies widely throughout the resource area and with elevation. Lifton pumping station, located at the north end of Bear Lake, has an average total annual precipitation of 10.62 inches based and a 1935 to 2007 period of record while on the north end of the resource area Conda reports an annual total average precipitation of 18.91 inches over a period of record from 1948 to 1978 (WRCC, 2007). Precipitation in the surrounding mountains ranges from 25 to 35 inches annually (BLM, 2000). The heaviest 1-day rainfall during the period of record at Montpelier was 2.50 inches on June 16, 1939. According to the Natural Resource Conservation Service (NRCS), thunderstorms occur on about 24 days each year, and most occur between May and August:

> "The average seasonal snowfall is 58.3 inches. The greatest snow depth at any one time during the period of record at Montpelier was 31 inches recorded on March 4, 1952. On an average, 108 days per year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 13.0 inches recorded on December 19, 1951."
>
> (NRCS, 2007)

The prevailing wind direction is from the west southwest, causing accumulation of snow on east and north facing ridges. Ralston et al. (1980) states that snow melt is the largest source of ground water recharge to the areas bedrock aquifers giving the east and north facing ridges the greatest potential for significant recharge.

2.4 General Geology

The Consolidated Mine lies within the northern region of the Basin and Range physiographic province and is characterized by linear, north-trending fault-bounded ranges and basins created by extensional tectonics initiated during the last 10 to 20 million years (Figure 4). Ranges in southeastern Idaho are generally composed of deformed Paleozoic and Mesozoic sedimentary rocks, including thick marine clastic units, comprising cherts and limestones. The valleys are largely in-filled with Quaternary alluvium and colluvium that overlie Pleistocene basalt flows. Middle Pleistocene rhyolite flows of the Snake River Plain regions cover much of the area and complete the geologic sequences in the region.

Massive accumulations of marine sediment occurred during the Paleozoic era over large areas of eastern Idaho. During the Permian Era, the Phosphoria Formation was deposited, forming the western phosphate field, part of which is located in the Idaho Phosphate Mining Resource Area.

2.5 Stratigraphy and Lithology

The stratigraphy of the area is characterized by Paleozoic and Mesozoic sediments overlain by Pleistocene igneous extrusions. The stratigraphy most encountered by mining activities in the area is generally limited to four principal rock units. The stratigraphy, approximate ages, and a description of each unit are summarized in Table 1.

Table 1. Generalized stratigraphic setting of project area[1].

Unit Name	Age	Description
Dinwoody Formation	Triassic	Interbedded claystone, limestone, and siltstone; ranges from 1,000 to 2,000 feet thick in project area
Phosphoria Formation	Permian	Composed of cherty mudstone, phosphatic mudstone, chert, phosphorite, limestone, and dolomite; phosphorite is the source of phosphate ore and is typically found in the lowermost portion of the formation.
Grandeur Limestone	Permian Pennsylvanian	Massive limestone that is discontinuous in the project area
Wells Formation	Pennsylvanian	Fine to very fine grain quartzitic to calcareous sandstone; approximately 1,500 to 2,000 feet thick in the project area.
Notes: 1. By convention, units are presented from top to bottom as youngest to oldest.		

At the eastern edge of the resource area, the Phoshporia Formation corresponds to an ancient ocean shelf and is more calcareous and less argillaceous than Phosphoria Formation outcrops to the west.

The Phosphoria Formation includes four members: Meade Peak Phosphatic Shale, Rex Chert, Cherty Shale, and Retort Phosphatic Shale. The Meade Peak member, which ranges in thickness from about 55 to 200 feet, is the oldest and is either overlain by the Rex Chert or the Cherty Shale. The Retort member is discontinuous and is found in the north and eastern parts of the resource area. The Meade Peak member of the Phosphoria Formation is the source of the majority of the produced phosphate ore. Concentrations of

phosphate minerals in the Meade Peak member are significantly higher that typical concentrations found in other marine sedimentary rock. (Montgomery Watson, 1998)

2.6 Structure

The Consolidated Mine and the surrounding area are located in the Idaho-Wyoming-Utah Overthrust belt, which extends from the Snake River Plain to near Salt Lake City and is part of the Cordilleran Foreland thrust belt that extends from Alaska to Mexico. Thrusting began in when movement began on the Paris Thrust, the westernmost thrust plate during the late Jurassic to early Cretaceous.

The major thrust plate in the study area is the Paris Overthrust. The ore bearing units at the Consolidation Mine consist of Pennsylvanian to Triassic age (Table 1), rock within an overturned syncline. The strata in the mine area are overturned and dip 55˚ westward, in the west limb of a syncline. They strike close to N45 ºW.

2.7 Hydrogeology

The major ground water flow systems within the phosphate mining resource area exist in the valley fill sediments, Thaynes, Dinwoody, and Wells formations. The Phosphoria formation has not been found to support any major ground water flow systems and generally acts as a confining unit between the Dinwoody and Wells formations.

Ground water flow in the valley sediments is generally from the valley margins towards the valley center then down valley towards lower elevations. Ground water flow within the bedrock aquifers is often controlled by stratigraphy and structural geology, flowing along the bedding in the direction of dip and/or plunge. Regional and localized faulting may form preferential flow paths or boundaries to ground water flow within the bedrock systems.

2.8 Current and Potential Future Land Uses

Current land uses in the area include biking, hiking, horseback riding, and off-road vehicle touring. The Consolidated Mine is accessible from an unnamed road in Little Canyon that branches north from Bloomington Creek Road.

2.9 Area Fish Species

According to the Idaho Department of Fish and Game (IDFG) database, fish in Bloomington Creek include redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], Bonneville cutthroat trout [Oncorhynhus clarki Utah], rainbow (hatchery) trout, and brook trout [Salvelinus foninalis] (IDFG, 2002). There is no information concerning the potential fish population in Little Canyon.

2.10 Wetlands

Official wetland surveys for the area indicate that Little Canyon contains no wetland areas. However, within a 15-mile radius there are approximately 13,100 acres of wetlands.

2.11 Future Land Use

Future land use could potentially include some year-round and/or seasonal homes on the private parcels of property. However, given the sparse population density in the area and the predominately sagebrush vegetation type, this land use is not anticipated in the near future.

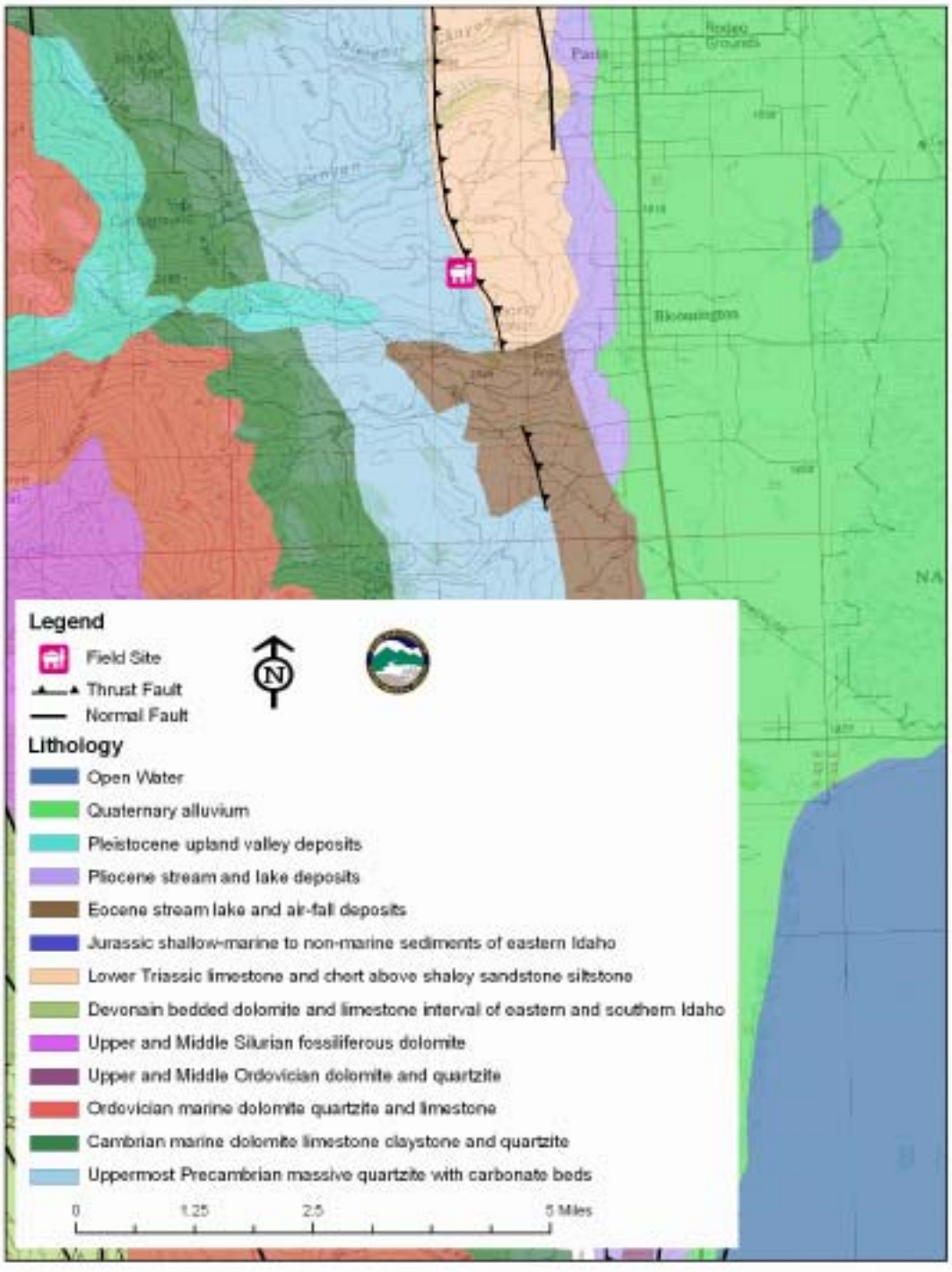


Figure 4. Geologic map of Consolidated Mine area.

Section 3. Site Overview, Sampling, and Waste Characterization

An interagency team conducted a site visit to the Hot Springs Mine during May 2002 (DEQ, 2004a) in accordance with the goals and objectives in the *Area Wide Risk Management Plan* (DEQ, 2004b). The visit included a visual inspection of the mine and the collection of three (3) vegetation samples (grasses), five (5) soil and sediment samples and one (1) duplicate soil sample. Sampling locations are shown in Figure 5 and in photos in the Appendix. Samples were analyzed for trace metals and compared to action levels developed for the Area Wide Rick Management Plan (DEQ, 2004b).

3.1 Area Wide Risk Management Plan Action Levels

The Area Wide Risk Management Plan was written as a discretionary guidance document to assist lead and support agency representatives with their mine-specific risk management decision-making responsibilities regarding historic mining operation releases and associated impacts from selenium and related trace metals in the Southeast Idaho Phosphate Mining Resource Area. The plan provides removal action goals, objectives, and action levels intended to assist in identifying site-specific areas of concern, focus regulatory resources, and support consistent decision-making using a regional perspective.

Risk-based action levels were developed using deterministic single media dose proportions as the initial basis. These action levels were then tested and validated using probabilistic methods, assuming simultaneous exposure from all action level media, to numerous limited-home-range surrogate species representing sensitive receptors from the various feeding guilds in the resource area.

Due to the limited area of impact and low likelihood of population-level effects, the action level development approach used by DEQ applied slightly less conservative assumptions regarding acceptable hazard quotient ranges than a typical population-level ecological risk assessment might. However, many of the receptor dose model parameters, such as site use, bioavailability, and secondary media exposure point concentrations, remained conservatively-biased to represent receptors residing exclusively in impacted areas during toxicologically critical periods, such as spawning, nesting, and breeding. The DEQ's risk management decisions focus resources in areas where efforts to minimize potential impacts to ecological subpopulations will provide the greatest benefit.

Action levels were established for the primary media that support sensitive habitats and are most amenable to standard industry measurement and mitigation techniques, which were surface water, groundwater, sediments, fluvial/riparian soils, and vegetation. Elevated contaminant concentrations in the selected action level media are also indicative of the presence of past and/or ongoing releases.

3.2 Sampling

Ten samples and two duplicates were collected at the site (Figure 5) as listed in Table 2 through Table 4: five soil, two vegetation, one surface water, and two duplicate samples.

- The first sample, designated OS-CMS-SO-01-01 (Appendix Photo 10.5), was a background soil sample taken upgradient from the mining activity. The sample was composed of dark brown to black, dry, "fluffy" organic soil with very little rock material collected in an area of thick sagebrush.
- Soil sample, OS-CMS-SO-02-01 (Appendix Photo 10.6), and its duplicate were taken on the side of a well-stratified eroding black shale waste dump in the stream channel. The sample was collected about 1 foot above the stream channel elevation. The sample was composed of black, high carbon, high sulfide shale.
- The next two samples were collected in the dry stream channel approximately 200 feet downgradient of the building site. Soil sample OS-CMS-SO-03-01(Appendix Photo 10.7) was composed of approximately 60% black shale, 20% Quartzite cobbles, and 20% sand. Vegetation sample OSCMS-VE-04-01 (Appendix Photo 10.7), was taken in the same location and consisted of an abundant unidentified grass species.
- Three additional samples were collected approximately 200 feet downgradient at the sediment trap (Appendix Photo 10.8). Soil sample OS-CMS-SO-05-01 is a soil sample taken from within the sediment trap. The sample was composed of approximately 90% transported black shale, 5% rounded limestone gravel and 5% sand. Sample OS-CMS-SW-06-01 (Appendix Photo 10.9) and duplicate sample OS-CMS-SW-06-02 are surface water samples collected about 60 feet downstream from the sediment trap. The temperature of the water at the time of sampling was 6.2 °C and the pH was 7.0.
- The last two samples were taken approximately 150 feet above the water tank at the confluence of the canyons. Sample OS-CMS-SO-07-01 was a soil sample of 20% transported black shale and 80% mix of sandstone and quartzite cobbles. OS-CMS-VE-08-01 was a vegetation sample of an unidentified grass species.

Figure 6 provides a sketch of the site created during the 2002 preliminary assessment.

3.3 Sampling Results

The background sample was collected on the ridge west of the main portal. Analytical results indicate that all soil concentrations were below the Area Wide Risk Criteria (AWRC).

Sample OS-CMS-SO-02-01 and the duplicate OS-CMS-SO-02-02, were collected on a black shale waste dump in the stream channel. Both samples showed elevated concentrations of cadmium (Cd), chromium (Cr), nickel (Ni), selenium (Se), vanadium (V) and zinc (Zn). These samples were approximately 8 to 80 times the AWRC, (Table 2).

Soil sample OS-CMS-SO-03 and vegetation sample OS-CMS-SO-04, were collected from the same location approximately 200 feet downstream of the building. The soil sample exceeded the AWRC for Cd, Cr, Ni, Se, V, and Zn (Table 2.) The vegetation sample exceeds the AWRC for Cd and Se only. (Table 3)

The soil sample OS-CMS-SW-05 was collected approximately 200 feet downstream from the sediment trap. Analytical results indicate that Cd, Cr, Ni, Se V, and Zn concentrations were above the AWRC.

Samples OSCMS-SW-06-01 and OS-CMS-SW-06-01were a surface water sample and duplicate collected approximately 60 feet downstream from the sediment trap. Only Se exceeded the AWRC for Riparian Habitat Use.

Soil sample OS-CMS-SW-07-01 and vegetation sample OS-CMS-VE-08-01 were collected approximately 150 feet above the water tank adjacent to Bloomington Canyon Road. The soil sample exceeded the AWRC for Cd, Cr, Ni, Se, V, and Zn. The highest exceedence was V at 85 times the AWRC. The vegetation sample exceeded the AWRC for Cd, and Se. Se was approximately 5 times the AWRC.



Figure 5, Consolidated Mine Sampling Locations

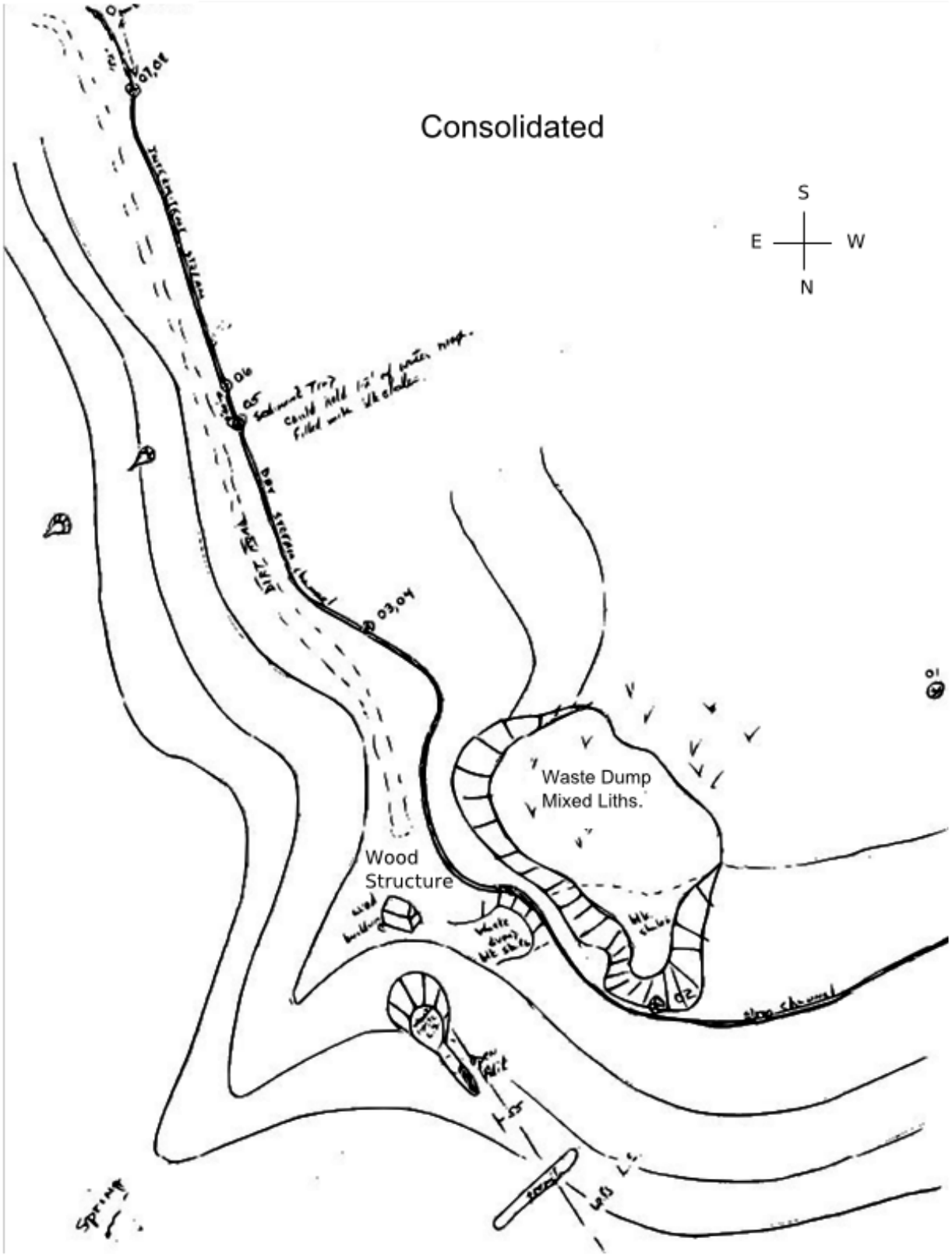


Figure 6. Consolidated Mine site sketch from DEQ (2004a).

Table 2. Consolidated Mine soil sampling analytical results.

Sample ID	Media	Metal Concentrations in Parts Per Million (ppm)								Species/Type
		Cd	Co	Cr	Cu	Ni	Se	V	Zn	
OS-CMS-SO-01-01	Soil	<0.75	9.9	35	20	19	0.49	48	75	Soil - Background
OS-CMS-SO-02-01	Soil	390	2.7	1600	200	340	200	6000	3300	Dump
OS-CMS-SO-02-02	Soil	380	2.8	1500	200	350	230	6000	3300	Duplicate
OS-CMS-SO-03-01	Soil	120	2.9	480	60	130	120	1400	1400	Soil
OS-CMS-SO-05-01	Soil	73	4.4	510	48	100	61	1400	990	Soil
OS-CMS-SO-07-01	Soil	410	9.5	1600	220	390	15	6100	3700	Soil
Area wide Risk Criteria		**9.2**		**187.0**	**402**	**44**	**7.5**	**72**	**210**	

Table 3. Consolidated Mine vegetation sampling analytical results.

Sample ID	Media	Metal Concentrations in Parts Per Million (ppm)								Species/Type
		Cd	Co	Cr	Cu	Ni	Se	V	Zn	
OS-CMS-VE-04-01	Vegetation	5.4	<0.12	0.43	14	9	37	0.52	470	Grass
OS-CMS-VE-08-01	Vegetation	4.8	0.24	1.2	14	7	27	4.2	410	Grass
Area wide Risk Criteria		**4.2**		**30.6**	**88.0**	**35.5**	**5.0**	**55.9**	**615.0**	

Table 4. Consolidated Mine surface water analytical results.

Sample ID	Media	Metal Concentrations in Parts Per Million (ppm)								Hardness Ca, Mg (mg/L as CaOH)	Species/Type
		Cd	Co	Cr	Cu	Ni	Se	V	Zn		
OS-CMS-SW-06-02	Surface water	0.001	<.0025	<.0005	<.00013	0.0068	0.024	0.017	0.069	54	Stream
OS-CMS-SW-06-02	Surface Water	0.0009	<.0025	<.0005	<.00013	0.007	0.021	0.017	0.087	54	Duplicate
Area wide Risk Criteria, Riparian Habitat Use		**0.245**		**8.7**	**11.0**	**0.614**	**0.005**	**0.972**	**43.4**		

3.4 Inspection Findings

The site supports a large open adit, an old wooden shed, and a number of waste rock dumps bisected by a dry wash creek bed (Appendix, Photo 10.1). The dumps measure approximately 300 feet by 100 feet and are approximately 25 feet high (approximately 28,000 cubic yards). Erosion from the dumps appears to be trapped by a sedimentation dam approximately 200 feet downgradient. The site is located within fenced property, and sediment releases appeared to be contained at the time of the site inspection (July 2002).

An open portal, leading to the production adit/decline, is located at the Phosphoria-Wells contact, and the surrounding rock is strongly oxidized. At the base of the portal is an approximate 15 foot wide and 35 foot long excavated area that leads to a well-vegetated waste dump composed mostly of oxidized limestone. The dump is approximately 20 feet wide by 10 by 15 feet high (110 cubic yards).

Visual observations indicate that a wooden building, possibly dating from the 1930s, stands at the end of the access road. About 150 feet up-slope from the building lies an open portal to the production adit/decline. The majority of the waste rock on the site is located on both sides of the canyon bottom. The intermittent stream bisects the waste.

Approximately 80% of the waste is strongly vegetated, while the remaining 20% has very little vegetation. Most of the unvegetated material is black shale, and most of the vegetated waste is a mixture of lithologies composed mostly of limestone and tan, oxidized shale. The combined waste dump size is approximately 200 feet long, 150 feet wide, and approximately 10 to 20 feet high (21,000 cubic yards). The intermittent stream channel appears to be cutting into and washing the waste material downstream with evident erosion occurring.

An exploration trench is located approximately 50 feet upslope, to the northwest of the main portal. The trench, which is about 50 feet long, 10 feet wide, and 10 feet deep, is almost completely covered in grass and runs perpendicular to the strike of the beds.

Two small exploration adits are located about 2,000 feet down the canyon (along the strike) from the main portal. These adits are situated about 175 feet and 350 feet up-slope from the canyon bottom, and each adit has a very small associated waste dump, (less than 3 cubic yards), composed of a mix of oxidized and unoxidized shales. These adit waste dumps are poorly-to-moderately vegetated.

Section 4. Pathway and Environmental Hazard Assessment

Risk pathways and environmental hazards were assessed for groundwater, surface water, and soil/air exposure. The findings from these assessments are presented in the following.

4.1 Surface Water

An intermittent stream channel runs through the site and bisects waste piles on both sides of the channel. The stream is generally dry through the mine area but begins to flow about a quarter mile downstream of the mine area.

A sediment trap crosses the channel about 50 feet upstream of where surface flow begins. A surface water sample collected approximately 60 feet downstream from the sediment trap shows that selenium concentrations exceeded the Idaho State Water Quality Rules for Surface Water, after adjustment for hardness in accordance with the Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02.210). Temperature of the water was 6.2 ºC and the pH was 7.0.

Little Canyon Creek drains south into Bloomington Canyon Creek, approximately two-thirds of a mile downstream from where the surface flow begins. It is not known whether this surface flow is continuous throughout the year.

Bloomington Creek flows east into Bear Lake Valley. Bloomington Creek is designated as a 303(d) stream for not meeting water quality standards for sediment (DEQ, 1998).

There are approximately 13,000 acres of wetland within the 15 mile Target Distance Limit (TDL) of the site. This area encompasses the large wetlands north and around the northern perimeter of Bear Lake.

4.2 Soil/Air Exposure

Access to the mine site is not restricted or posted, but there is a reported fence around the mine adit. A spur road from the main access road up Bloomington Creek allows public access to the site. Four-wheel drive vehicles may be able to drive down through Little Canyon on old abandoned roadways.

Due to the remoteness of the site, soil ingestion for occasional recreation is considered minimal. Additionally, exposure to airborne contaminants should be minimal due to the remote location and the reported good vegetation on approximately 80 % of the waste piles and excavations.

4.3 Groundwater

Idaho Department of Water Resources (IDWR) records show ground water flow in the area moves from the highlands eastward toward the Bear Lake Valley floor. This flow is

consistent with the topography of the area. It should be noted that the mine is located on or close to a fault (Figure 4), which may also affect local ground water flow patterns. In the Little Canyon drainage, water from the intermittent stream surfaces approximately one-quarter mile downstream from the mine. The only other identified spring in the area is located approximately one-half mile west of the mine with an elevation approximately 200 feet higher than the mine.

Water levels from domestic wells nearest to the site vary from 218 feet below ground surface (bgs) on the ridge near the mine to approximately 18 feet bgs along Bloomington Creek, to approximately 3 feet bgs on the valley floor.

According to IDWR records, 26 domestic water wells are reported to be located within a 4-mile radius of the site (Figure 3). The majority of these wells are located along Bear Lake Valley, close to the nearby towns of Bloomington and Paris. Three public water systems are located within a 4-mile radius of the site:

- The City of Bloomington spring well is located 2 miles WSW of the site. According to Safe Drinking Water Information System (SDWIS) data (DEQ, 2006), this system services 585 users and has no water issues.
- The City of Paris spring well is 2.5 miles WNW of the site. According to SDWIS, the system services 251 users, and has had detections of selenium (1982 and 1999), arsenic (1996) and cyanide (1992). However, all the detections have been below Maximum Contaminant Levels (MCLs).
- The USFS Paris Springs Campground spring well is located 3.2 miles WNW of the mine. According to SDWIS, the spring well services 25 users and has had no water issues. This well is sampled for nitrates only.

The public water wells shown in Figure 3 are upgradient from any of the mining activities; the blue hatching represents travel time for groundwater to migrate from the perimeter of the hatching to the extraction well. This gives a relative groundwater travel time for the area west of the mine. East of the mine site wells appear to be completed in the alluvial materials associated with the Bear Lake Valley. Here groundwater is very shallow and would travel at a much faster rate than in the surrounding highlands.

4.4 Potential Receptors

Potential receptors include local residents, hunters, anglers, cattlemen, trail riders (motorized and non-motorized), campers, and, rarely, tourists. Cattle activity surrounding and within the mine site is unknown. Residents and outdoor enthusiasts remain the likeliest potential receptors, as they reside nearby or use surrounding land for recreational activities.

The land within a two-mile radius of the site is primarily BLM land, but minor amounts of private land exist. The parcels of land occupied by the mines and waste dumps are owned by private parties.

4.4.1 Schools, Day-Care Facilities, Private Residences

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

4.4.2 Plant and Animal Species of Concern

Species of concern in the proximity of the site are shown in Figure 7. Species of concern within four miles of the site include the Northern Leopard Frog, Big eared Bat, and the Flammulated Owl.

Red Glasswort and Purple Meadow-rue are the only plant species of concern within the 15 mile TDL of the site. Animal species listed as a species of concern located within the 15 mile TDL include the California Gull, Eared Grebe, Western Grebe, Northern Leopard Frog, Double-crested Cormorant, Snowy Egret, Cattle Egret, White-faced Ibis, Franklin's Gull, Caspian Tern, Black Tern, Flammulated Owl, Townsend's Big-eared Bat, Black-crowned Night-heron, Forster's Tern, Whooping Crane, Bald Eagle, and Trumpeter Swan (F&G, 2002).

4.4.3 Soil Sample Concentrations

Soil samples contained the following concentrations:

- Selenium (Se) from 15 to 230 mg/kg
- Copper (Cu) from 60 to 200 mg/kg
- Cadmium (Cd) from 73 to 390 mg/kg
- Chromium (Cr) from 480 to 1,600 mg/kg
- Vanadium (V) from 1,400 to 6,100 mg/kg
- Mercury (Hg) from 0.01 to 0.7 mg/kg
- Nickel (Ni) from 130 to 350 mg/kg
- Zinc (Zn) from 1,400 to 3,700 mg/kg

Complete analytical results are presented in Table 2. Arsenic was not analyzed for during this sampling event.

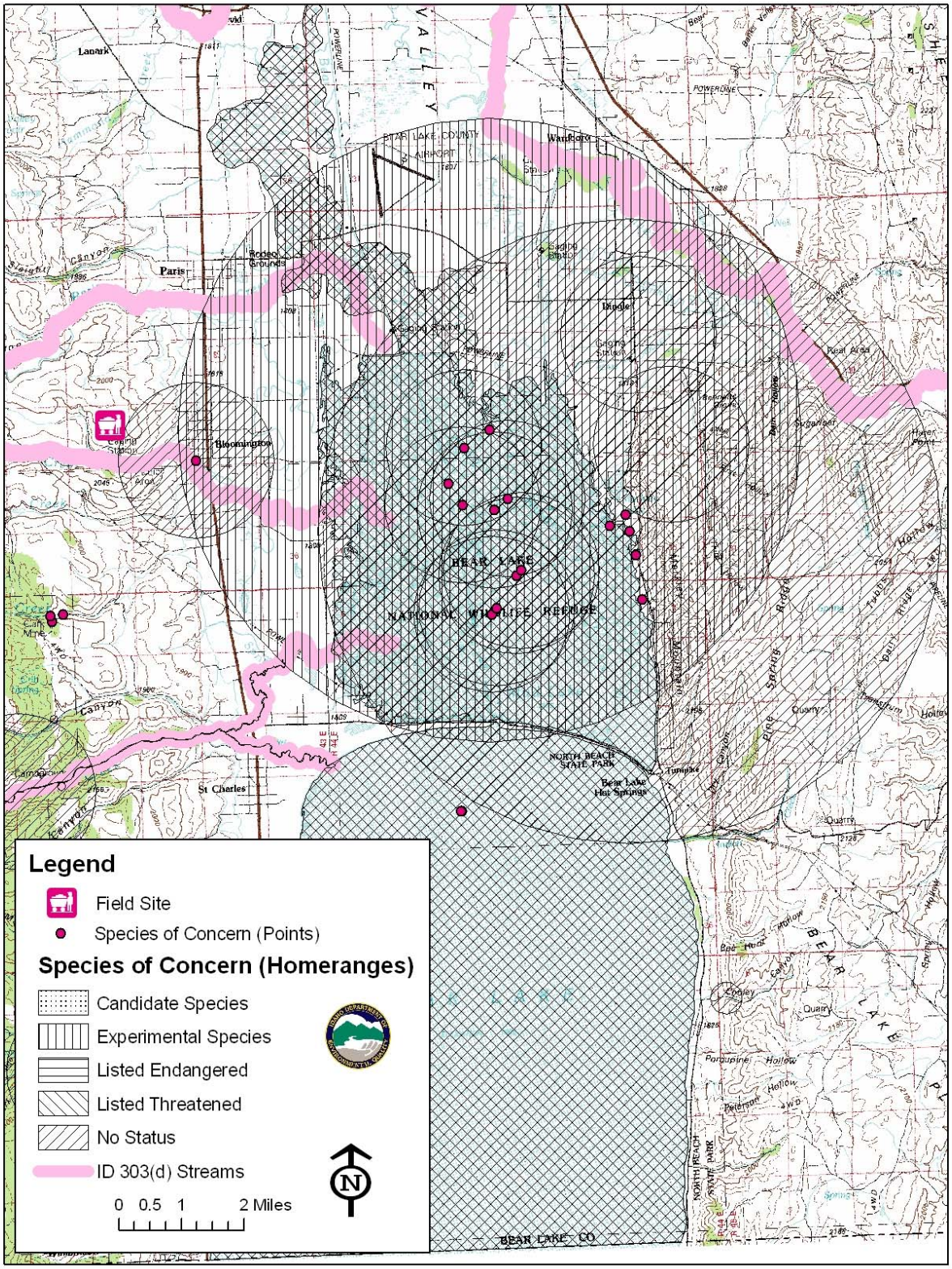


Figure 7. Species of Concern within the Consolidated Mine area.

Section 5. Conclusions and Recommendations

The recommendations contained herein address not only localized release pathways and associated ecological risks but also any public safety concerns regarding the presence of open adits, portals, or mine shafts. The Consolidated Mine is recommended for additional sampling, potential erosion control, and reclamation improvements. Additional actions, in the form of further site investigations, waste consolidation, erosion controls, and reclamation improvements, are also recommended.

5.1 Presence of Wetlands

Based on official wetland surveys and aerial photographs of the area, approximately 13,100 acres of wetlands exist near the site or within the 15-mile TDL. However, potential impacts to wetland areas by this mine site appear minimal.

5.2 Impacts on Water Quality

The surface water sample collected approximately 60 feet downgradient from the sediment trap showed elevated concentrations of selenium (24 µg/l) above the Area Wide Risk Management Plan criteria for riparian habitat use and state water quality rule for regulated surface water (5 µg/l). As this was the only surface water quality sample collected, it is difficult to evaluate the impacts of the site on all surface water within the area of the mine site. Additionally, the sample was collected about one-third of a mile upstream from Bloomington Creek, therefore, potential impacts to the creek are not known.

Although groundwater data around the vicinity of the mine are sparse, there are no known groundwater impacts, and the nearby public water systems are located west and upgradient from the site. Potential downgradient receptors are at least one mile away. According to driller's logs, these wells are located in valley sediments containing very shallow groundwater, which may represent an entirely different aquifer system than the Consolidated Mine.

5.3 Potential Exposure for Wildlife and Vegetation

The waste rock piles may present potential exposure for wildlife and vegetation. According the 2002 preliminary assessment (DEQ 2004), approximately 80% of the waste piles are strongly vegetated while the remaining 20% had very little vegetation on them. Vegetation appears to flourish around the mine area. Native plant species may bio-accumulate high concentrations of metals that may be consumed by the local wildlife. Wildlife, such as deer and elk, that may be exposed to elevated concentrations of metals (via water, soil, or plant material) may be harvested and consumed by humans.

5.4 Potential Exposure for Humans

The public has access to the mine via the roads. There are no locked gates or posted signs in proximity to the mine site, but there is reportedly a fence around portions of the property (DEQ 2004a). It could not be determined from the 2002 preliminary assessment, however, how extensive the fenced area around the site is.

Commercial or subsistence fishing does not occur within the 15-mile downstream distance, but sport fishing does. According to the IDFG database, redband rainbow trout, Bonneville cutthroat trout, rainbow (hatchery) trout, and brook trout are present in Bloomington Creek (IDFG, 2000).

Human activity around the mine site is minimal, although observations made during the site visit indicated evidence of recent human activity in Little Canyon. Mountain bikers, hikers, hunters, snow mobile operators, off-road four wheeling enthusiasts, and various other outdoor recreation enthusiasts may potentially frequent the area because access is not restricted.

Fugitive dust and direct contact with the waste piles are the two main mechanisms through which humans could be exposed to the metal concentrations at the site. These sources do not appear to present any immediate threat. Although the waste piles have been shown to have high metal concentrations, exposure for humans to elevated metal concentrations is low due to the remoteness of the site.

5.5 Recommendations

Overall, the soil, vegetation, and surface water samples from the site showed elevated metal concentrations with respect to the Area Wide Risk Management Plan criteria. As a result, the agencies performing the 2002 preliminary assessment recommended additional actions at the Consolidated Mine site in the form of further site investigation, waste consolidation erosion controls, closing adits, and openings on the site, and reclamation improvements DEQ, 2004a).

Based on DEQ's current evaluation of the data, additional recommendations include the following:

- Observation of the creek to determine if it is perennial and collection of additional samples to determine potential impacts to Bloomington Creek.
- Re-contouring and re-vegetating those waste piles where natural vegetation has not established itself, and, if necessary, placement of clean soils and re-vegetation of these locations.
- Sampling of Bloomington Creek upgradient and downgradient of Little Canyon to determine potential impacts.

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Appendix: Photographs

The following photographs were taken during the Preliminary Assessment (DEQ, 2004a).



Photo 10.1
Consolidated Mine, view to south, down Little Canyon.



Photo 10.2
Excavated area below main portal. View to south.



Photo 10.3
Consolidated Mine, main portal, open. View to north.



Photo 10.4
Consolidated Mine, exploration trench [by Wyodak] above portal. View to northeast.

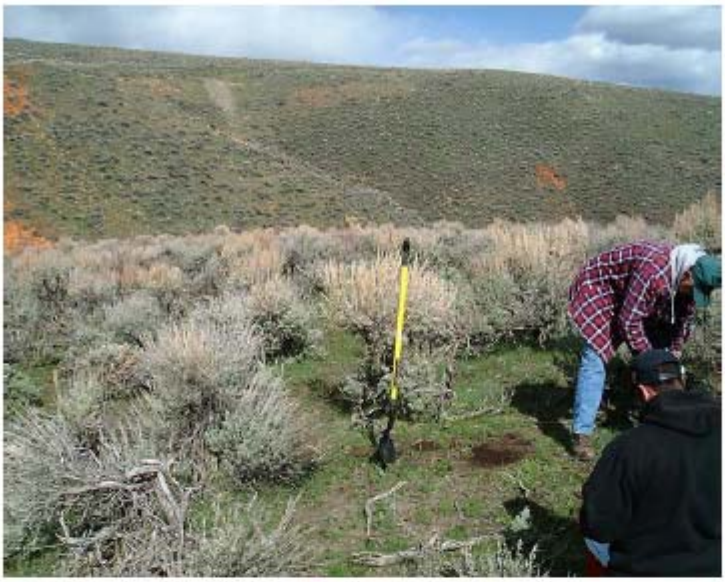


Photo 10.5
Consolidated Mine, sample OS-CMS-SO-01-01. View to east.



Photo 10.6
Consolidated Mine, sample OS-CMS-SO-02-01. Stratified waste dump dissected by intermittent stream. View to southwest.



Photo 10.7
Consolidated Mine, sample location for OS-CMS-SO-03-01 and OS-CMS-VE-04-01. Considerable black shale in stream channel. View to south.



Photo 10.8
Consolidated Mine, sample OS-CMS-SO-05-01. Upstream side of sediment dam. Majority of rock material is black shale. View to south.



Photo 10.9
Consolidated Mine, sample OS-CMS-SW-06-01, about 60 feet below sediment dam. View to south, down stream.



Photo 10.10
Consolidated Mine, upper exploration adit. View to southeast.



Photo 10.11
Consolidated Mine, lower exploration adit. View to southeast. Upper exploration adit located in upper left of photo.

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