Site Inspection Report
Rainy Mine
Mt. Baker-Snoqualmie National Forest

July 2005

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SITE INSPECTION
Rainy Mine
Mt. Baker-Snoqualmie National Forest

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Prepared for: USDA Forest Service
Mt. Baker-Snoqualmie National Forest

Site Location: Rainy Mine
Mt. Baker-Snoqualmie National Forest
King County, Washington

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PN: 2423004/July 2005

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EXECUTIVE SUMMARY

A Site Inspection (SI) was performed at the Rainy Mine (Site), located in the Mt. Baker-Snoqualmie National Forest, near North Bend, Washington. The Site is an abandoned copper mine situated adjacent to Quartz Creek in Washington's Central Cascades and consists of one adit (Adit 1), a shaft, mill foundation, two wasterock piles (WR-1 and WR-2), and miscellaneous debris. The SI was conducted to assess if the Site poses an immediate and potential threat to human health and the environment, and to collect sufficient information to support a decision regarding the need for further action. Based on the information gathered during these tasks, the results indicate the following:

Groundwater Pathway: The groundwater pathway is incomplete because there are no wells or groundwater protection areas within a 4-miles radius of the Site. Therefore, further assessment is not recommended.

Surface Water Pathway: The surface water pathway is complete for both human and ecological receptors due to elevated concentrations of metals in stream sediments, surface water, and pore water and further assessment is warranted. High concentrations of metals are being discharged to Quartz Creek from the seeps emanating from WR-1. In addition, the unnamed drainage adjacent to Adit 1 flows across WR-2 and carries elevated concentrations of aluminum and arsenic into Quartz Creek. Arsenic concentrations in surface water, pore water, and sediment samples collected adjacent to the Site (Adit 1 and WR-1) were higher than background concentrations, indicating an impact from the Site.

Rainbow trout, a state priority species, are known to be present in the MFSR. In addition, cutthroat trout, a federal species of concern, have been documented to occur in Quartz Creek and the Taylor River. The benthic invertebrate survey results for riffle habitats suggest that the number and diversity of invertebrates decrease downstream of the Site indicating a decrease in water quality downstream from the Site. However, the results of for pool habitats, indicative of sediment quality, do not provide any conclusive evidence of mine-related impacts downstream of the Site.

Soil Pathway: The soil exposure pathway is complete for both human and ecological receptors, and a release of hazardous substances has been documented in this SI. This is based on concentrations of 14 metals in wasterock and soil exceeding both the average background soil concentration and the lowest comparison criteria. Arsenic (III, V, and total), copper, and silver appear to be the metals of concern. No samples exceeded the Ecology Dangerous Waste limit. Wasterock at the Site does have the potential to produce acid rock drainage. Onsite vegetation does not appear to be impacted by mining activities associated with the Site. No terrestrial rare, threatened or endangered species were observed; however, several have the potential and are expected to habitat in the vicinity of the Site

Air Pathway: The air pathway is considered complete because metal impacted soil and wasterock is concentrated at the surface where human and ecological receptors could be exposed to particulate matter. Addressing and/or eliminating the soil exposure pathway will likely render the air exposure pathway incomplete. Therefore, further assessment of the air pathway is not recommended.

Based on the information gathered as part of the SI and presented in this report, CES recommends performing an Engineering Evaluation / Cost Analysis (EECA) at the Site. Since the SI activities were performed while snowmelt was a considerable part of the stream flow, it is recommended that low flow sampling (i.e. fall) be conducted to assure a complete water quality assessment has been made. As part of the EECA, a risk assessment should be performed to assess the human and ecological impacts, establish removal cleanup standards, and assess if a removal action are warranted. Physical dangers (i.e. opened adits, collapsed shafts, etc.) should also be included as part of the EECA.

SITE INSPECTION DATA SUMMARY SHEET

Project Name: Rainy Mine Site Inspection
Project Location: T 24 N, R 10 E Section 16, NW ¼ **Latitude:** N47° 34' 13.3" **Longitude:** W121° 33' 20.5"
Project Location: T 24 N, R 10 E, Section 9, SW ¼ **Latitude:** N47° 34' 10.0" **Longitude:** W121° 33' 08.8"
Nearest Surface Water Body: Quartz Creek
Area of Disturbance: ~2 acres

SUMMARY OF ANALYTICAL/DOCUMENTED CONTAMINATION

Media	Sample Location	Flowrate/ Volume (cfs, gpm, or cy)	Contaminant	Highest Concentration	Lowest Criteria Eco – Ecological HH – Human Health	Background Concentration
Surface Water	RM-Seep SW1	0.31 gpm	Aluminum Arsenic Arsenic V Barium Copper Iron Zinc	1,260 µg/L 14.1 µg/L 14.1 C ug/L 8 B µg/L 687 µg/L 580 µg/L 20 B µg/L	87 µg/L – Eco 0.018 µg/L – HH 3.1 µg/L – Eco 4 µg/L – Eco 1.2 µg/L – Eco 300 µg/L – Eco 13.34 µg/L – Eco	80 B µg/L 1.1 B µg/L 0.91 C µg/L < 3 µg/L <0.5 µg/L <10 µg/L <10 µg/L
	RM-Seep SW2	0.24 gpm	Aluminum Arsenic Barium Cadmium Copper Zinc	2,890 µg/L 1.9 B µg/L 14 µg/L 0.7 µg/L 2,020 µg/L 60 B µg/L	87 µg/L – Eco 0.018 µg/L – HH 4 µg/L – Eco 0.04 µg/L – Eco 1.2 µg/L – Eco 13.34 µg/L – Eco	80 B µg/L 1.1 B µg/L <3 µg/L <0.1 µg/L <0.5µg/L <10 µg/L
	RM-AWR-SW-3	1.0 gpm	Arsenic V Arsenic Copper	52.3 C µg/L 57.7 µg/L 2.1 B µg/L	3.1 µg/L – Eco 0.018 µg/L – HH 1.2 µg/L – Eco	0.91 C µg/L 1.1 B µg/L <0.5µg/L
Pore Water	QC-PW-4	NA	Copper	1.9 B µg/L	0.8 µg/L – Eco	<0.5 µg/L
	RM-Seep-PW1	NA	Aluminum Barium Cadmium Copper Iron Zinc	1,320 µg/L 17 µg/L 0.5 µg/L 409 µg/L 9,360 µg/L 70 µg/L	87 µg/L – Eco 4 µg/L – Eco 0.03 µg/L – Eco 0.8 µg/L – Eco 1,000 µg/L – Eco 9.2 µg/L – Eco	50 B µg/L <3 µg/L <0.1 µg/L <0.5 µg/L <10 µg/L <10 µg/L
	RM-Seep-PW2	NA	Arsenic, V Cadmium	28.42 C µg/L 0.2 B µg/L	3.1 µg/L – Eco 0.03 µg/L – Eco	0.91 C µg/L <0.1 µg/L
Sediment	QC-SS-3	NA	Arsenic Copper	22.6 mg/kg 145 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco	9.5 mg/kg 18 mg/kg
	QC-SS-4	NA	Arsenic	15.3 mg/kg	5.9 mg/kg – Eco	9.5 mg/kg
	RM-Seep SS-1	NA	Arsenic Cadmium Copper Silver	179 mg/kg 1.27 mg/kg 4,410 mg/kg 4.79 mg/kg	5.9 mg/kg – Eco 0.6 mg/kg – Eco 35.7 mg/kg – Eco 1.8 mg/kg – Eco	9.5 mg/kg 0.39 mg/kg 18 mg/kg 0.04B mg/kg
	RM-Seep SS-2	NA	Arsenic Copper Silver	205 mg/kg 2,620 mg/kg 33.9 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco 1.8 mg/kg – Eco	9.5 mg/kg 18 mg/kg 0.04 B mg/kg
Site Soils	RM-S1 RM-S2 RM-S3	NM	Arsenic Copper Lead Selenium Silver	299 mg/kg 1,660 mg/kg 79.6 mg/kg 10.2 mg/kg 41.1 mg/kg	1.6 mg/kg – HH 50 mg/kg – Eco 40.5 mg/kg – Eco 0.21 mg/kg – Eco 2 mg/kg – Eco	31.2 mg/kg 200 mg/kg 31.4 mg/kg 0.37 mg/kg 0.4 B mg/kg
Wasterock (East Zone, near Mill and Shaft)	RM-WR1-1 RM-WR1-2 RM-WR1-3 RM-WR1-4 RM-WR1-5	2,000 cy	Arsenic V Arsenic Chromium Copper Selenium Silver Vanadium	221.7 C mg/kg 222 mg/kg 12 B mg/kg 1,970 mg/kg 11.1 mg/kg 41.3 mg/kg 67 mg/kg	10 mg/kg – Eco 1.6 mg/kg – HH 0.4 mg/kg – Eco 50 mg/kg – Eco 0.21 mg/kg – Eco 2 mg/kg – Eco 2 mg/kg – Eco	30.8 mg/kg 31.2 mg/kg 5.3 mg/kg 200 mg/kg 0.37 mg/kg 0.4 B mg/kg 26.4 mg/kg
Wasterock (West Zone, near Adit)	RM-WR2-1	25 cy	Arsenic III Arsenic V Arsenic Copper Selenium Silver Zinc	28.08 mg/kg 15,772 C mg/kg 15,800 mg/kg 1,310 mg/kg 4.4 mg/kg 15 mg/kg <100 mg/kg	7 mg/kg – Eco 10 mg/kg – Eco 1.6 mg/kg – HH 50 mg/kg – Eco 0.21 kg – Eco 2 mg/kg – Eco 8.5 mg/kg - Eco	0.411 mg/kg 30.8 mg/kg 31.2 mg/kg 200 mg/kg 0.37 mg/kg 0.4 B mg/kg 63.7 mg/kg

Notes: This table only lists sample concentrations that are at least 1.5 times higher than the lowest criteria and background concentration are listed. These exceedances are considered the major contaminants of concern (COCs) and not a complete list of all COCs.
Background water and sediment concentrations are the highest detected; background soil concentrations listed are the average of three samples.
Unless otherwise shown: surface water = total recoverable metals; pore water = dissolved metals, and all sediment and solid media = total metals.
ug/L = micrograms per liter; mg/kg = milligrams per kilogram; C = calculated concentration; B = analyte detected between MDL and PQL

1.0 INTRODUCTION AND OBJECTIVES

The United States Forest Service (USFS) retained Cascade Earth Sciences (CES) to perform a Site Inspection (SI) at the Rainy Mine (Site). The SI was performed in accordance to the U.S. Environmental Protection Agency (EPA) publication, *Guidance for Performing Site Inspections Under CERCLA* (USEPA, 1992). The purpose of the SI is to determine the potential threat to human health and the environment from issues identified during the Abbreviated Preliminary Assessment (APA) (USFS, 2003) conducted by the USFS at the Site. The work was performed under our existing 5-year USFS Contract (#10181-1-D007) and in accordance with the Purchase Order #53-05K3-4-0005.

The primary objectives of the SI were to (1) assess the immediate or potential threat that (mining) wastes pose to human health and/or the environment, and (2) collect sufficient information to support a decision regarding the need for further action. The information was collected in general accordance with CERCLA protocols and documentation requirements for assessments involving hazardous substances. Specifically, as outlined in the EPA CERCLA guidance document (EPA, 1992), "the sampling locations are strategically planned to identify the substances present, determine whether hazardous substances are being released to the environment, and determine whether hazardous substances have impacted specific targets."

The SI field activities included sampling and analysis of soil, wasterock, plant tissue, surface water, pore water, and sediment samples from the Site and vicinity. This SI was performed following the Field Operation Plan (FOP) developed by CES, and approved by the USFS on May 12, 2004 (CES, 2004). The FOP was developed based on the APA completed by the USFS in 2003 and the Statement of Work (SOW) provided by the USFS in the request for proposals dated October 15, 2003. During and prior to field activities, CES made several modifications to the sampling locations and analyses after discussions and concurrence with the USFS Contracting Officers Representative (COR). These changes are summarized in a letter to the USFS dated September 11, 2004 (Appendix A).

2.0 SITE DESCRIPTION AND OPERATIONAL HISTORY

The following sections give a specific description of the Site location and an operational history of the Site. Photographs of the Site and sampling locations are included in Appendix B. No regulatory removal actions have been undertaken at the Site. However, an Abbreviated Preliminary Assessment (APA) was performed by the USFS in 2003 (USFS, 2003). Results of the APA are discussed in Section 2.3 of this report. No permits or violations have been documented at the Site. Historical mine maps, sketches and miscellaneous information are included in Appendix C.

<u>2.1 Description and Location</u>

The Site is located in the Mt. Baker-Snoqualmie National Forest in King County approximately 12 miles northeast of North Bend, WA (Plate 1). The Site lies adjacent to Quartz Creek, a tributary of the Taylor River which flows into the Middle Fork of the Snoqualmie River (Plate 1). According to the USGS 7 ½ Minute Quadrangle Map – Lake Philippa (USGS, 1989), the Site location is described as:

- Township 24 North, Range 10 East of the Willamette Meridian, Section 9 and 16
- West Zone Adit — Latitude: North 47° 34' 13.3"
- Longitude: West 121° 33' 20.5"
- East Zone workings — Latitude: North 47° 34' 10.0"
  Longitude: West 121° 33' 08.8"
- Elevation — West Zone: 1,870 feet above mean seal level (amsl)
  East Zone: 1,790 feet amsl

Figure 2 provides a general layout of the Site, including 2-foot contours and pertinent features. The Site is accessed from North Bend by proceeding northeast on County Road 56 along the Middle Fork of the Snoqualmie River (MFSR) for approximately 12 miles to the Taylor River and

Forest Service Road (FR) 5640. Proceed approximately 2 miles north on FR 5640 over the Taylor River bridge. The Site is located on the southwest side of FR 5640 and is marked by an overgrown access road and well established trail. The Site is located on a steep, heavily forested, slope adjacent to Quartz Creek, which discharges to the Taylor River and ultimately to the MFSR near North Bend.

The Site is divided into the east and west zones. The east zone consists of a double compartment shaft and winze, a mill foundation, miscellaneous debris and a large wasterock pile (WR-1). Small exploration workings and prospects are also located east of WR-1. The volume of WR-1 is approximately 2,000 cubic yards (cy) and consists mainly of brown to yellow silty sand and gravel, with ubiquitous angular cobble and larger size rocks. Two seeps emanate from the base of the WR-1, creating a marshy area that eventually drains into Quartz Creek. In addition, iron precipitates were observed in the marsh area near the seeps and Quartz Creek. Tailing were not observed and were most likely discharged directly to Quartz Creek, a common practice prior to 1965.

The west zone contains one adit (Adit 1) and a small wasterock pile (WR-2). The volume of WR-2 is approximately 25 cy and consists of yellow to brown silt, sand and angular cobbles.

2.2 Operational History

The Site is currently inactive, but active mining claims blanket the Site. A search of Bureau of Land Management records indicates that the Site is encumbered by the Rainy (ORMC22468), Rainy #1 (ORMC22469), Rainy #2 (ORMC22470), and Rainy #3 (ORMC22471) lode claims. A Public Law 167 determination was completed in 1965 for the Rainy Lode and it was determined that the claimants do have surface rights. Surface rights were waived by the claimants for the Rainy #1, Rainy #2, and Rainy #3 lodes (USFS, 2003). The claimants for all four claims and their addresses are as follows:

David M. Gilbreath
509 223rd Street SW
Bothell, WA 98021

Robert C. Jackson
P.O. Box 809
Ravensdale, WA 98051

The following information is a summary of the ownership and operational history of the Site and the estimated ore production gleaned from Grant (1965), Livingston (1971), Derkey (1990) and Huntting (1956):

- 1946: M.F. Gilbreath relocated the original claims and staked additional ground.
- 1951: A 50 ton-per-day floatation mill, bunkhouse, and assayer shed were constructed on the property (Grant, 1965), processing information was not available. The mill was utilized until 1954 to process test shipments of ore.
- 1952: Property was leased to the Western States Copper Company.
- 1957: Anaconda Copper Company explored the property and drilled 2,128 feet of borings.
- 1967: Inland Copper Ltd. advancing 6 holes covering 1,900 feet with an estimated reserve of 5,200,000 tons ore at 0.5 to 0.6% copper.

A Report of Mineral Examination for 28 unpatented mineral claims of the Rainy property reported production amounting to 2,000 tons of ore from 1951 to 1957 (USFS, 2003). Total production from 1952 to 1956 was 363 tons of ore, yielding 127, 974 pounds of copper, 3,377 ounces of silver, and 94 ounces of gold.

2.3 Previous Investigations

In 2003, the USFS performed an APA, which consisted of collecting several samples from wasterock piles at the Site (USFS, 2003). A Niton XRF 700 Series, using *in situ* field screening methods, was utilized to help in the preliminary screening of the Site. Results show arsenic was detected at concentrations ranging from 63.3 milligrams per kilogram (mg/kg) to 145.2 mg/kg in WR-1. Arsenic was also detected at 139 mg/kg in the sample collected from the seep sediment. Field pH measurements from the WR-1 seeps ranged from 4.7 to 6.5 standard units (su) indicating potential acid rock drainage directly to Quartz Creek.

2.4 Climate

Climate data were compiled from the Snoqualmie Pass, Washington monitoring station (WRCC, 2004), located approximately 12 miles southeast of the Site at an elevation of 3020 feet amsl. The Site, located approximately 1,200 feet lower in elevation than monitoring station, likely receives less total precipitation and has higher minimum and maximum temperatures.

- Total average precipitation is approximately 105 inches per year.
- The average minimum temperature of approximately 21° F occurs in January.
- The average maximum temperature of approximately 70° F occurs in July.

3.0 PATHWAYS AND ENVIRONMENTAL HAZARD ASSESSMENT

3.1 Groundwater Exposure Pathway

3.1.1 Targets

Targets are defined as receptors that are located within the target distance for a particular pathway. As outlined in the SI CERCLA guidance (EPA, 1992) the target distance for the groundwater pathway is four miles, and example targets are drinking water wells and wellhead protection areas. There are no known residences or wellhead protection areas within a 4-mile radius of the Site. A review of the Washington Department of Ecology (Ecology) Water Resources Department well log database indicates that there are no water supply wells located within a 4-mile radius of the Site.

3.1.2 Geologic Setting

Regional geologic information presented in this section was obtained from Orr and Orr (2002). Site-specific geology was compiled from Huntting (1956) and Grant (1965) as well as site-specific reconnaissance performed by a CES Washington Registered Geologist.

3.1.2.1 Regional Geology

The Site is located in the Olney Pass Terrance (Western Mélange Belt) within the North Cascades physiographic province. The North Cascades is comprised of folded, faulted and metamorphically altered rocks ranging in age from Precambrian through Lower Cretaceous. The province is subdivided into numerous terranes which were accreted onto the North American plate during the Cretaceous. The Olney Pass Terrane is an incredibly coarse mixture of enormous sandstone blocks, some measuring thousands of feet across, set in a shaley matrix. This area of the Cascades, containing shale, chert and pillow basalt is indicative of volcanic island arc environments, and has been interpreted as an ancient subduction zone between two converging tectonic plates where the rocks were thoroughly fragmented before being jammed together in a chaotic mélange. The accreted terranes were intruded by Tertiary plutons and dotted with Quaternary age volcanoes.

3.1.2.2 Site Specific Mining Geology

The Site lies close to the margin between Upper Jurassic-Lower Cretaceous shales, graywackes and conglomerates and a large intruding body of Tertiary granodiorite known as the Snoqualmie batholith. The batholith in the vicinity varies in composition from diorite to granodiorite to granite. The mineralized zones occur near the periphery of the Snoqualmie batholith and are concentrated in two breccia pipes, east zone and west zone, about 800 feet apart (Derkey and others, 1990).

The east zone contains a massive pyrite body 30 feet in diameter within an altered zone 200 feet by 40 feet. The surface dimensions are 300 feet by 600 feet. The breccia consists of biotitized quartz diorite fragments and a matrix of mostly quartz with minor sulfides. Sulfide lenses within the pipe vary in width from 4 to 23 feet with length exceeding 100 feet and contain from 5 to 8% copper. There are at least three known lenses present and likely several more. Pyrite and chalcopyrite are the dominant sulfides in two lenses with pyrrhotite and chalcopyrite dominant in the other. The lenses appear to dip 30° south. Post-mineralization faults striking approximately east-west have offset the ore lenses approximately 10-15 feet (Grant, 1965). Underground workings in the east zone consist of an adit level, a 100-foot level, a 116-foot double compartment timbered winze and a 40-foot raise to surface. A 70 foot caved adit, reportedly located 150 feet south of the winze, was not located.

The west zone consists of hydrothermal shattering and mineralization by fracture filling of an altered zone 200 feet by 100 feet consisting of quartz veinlets along east-west fractures containing arsenopyrite, chalcopyrite and molybdenite. Pyrite is relatively rare in the west zone. Copper content ranges from 0.7 to 1.3% (Grant, 1965). Underground workings in the west zone consist of a 98-foot adit, and numerous small open cuts located throughout the area.

The primary ore minerals at the property are chalcopyrite, brannerite, pyrite, pyrrhotite, molybdenite, and arsenopyrite; primary gangue minerals are quartz, and tourmaline (Derkey and others, 1990). Copper, silver, and gold were the main commodities produced from the property.

3.1.3 Hydrogeology

The Site is located within the Quartz Creek sub-watershed of the Taylor River watershed and there are no known water supply wells located within 4-miles of the Site. A review of well logs drilled on the Middle Fork Road by the USFS indicates the shallow geology of the MFSR consists of sand and gravel to 40 feet BGS. Fracture flow likely dominates the hydrogeology in the vicinity of the Site. The shaft and winze are reportedly flooded (Derkey and others, 1990). Standing water was also observed in Adit 1; however, there was no evidence that water flowed from this adit. Two seeps were observed flowing from the based of WR-1 and discharging into Quartz Creek. The source of these seeps is unknown; it is possible that groundwater is seeping from the underground workings.

3.1.4 Groundwater Exposure Pathway Summary

Groundwater is not used for drinking water within 4-miles of the Site. Based on this, the groundwater pathway is incomplete and no further assessment is warranted.

3.2 Surface Water Exposure Pathway

3.2.1 Targets

For the surface water pathway, the target distance has been defined as 15-miles, and example targets are surface water intakes supplying drinking water, sensitive environments (i.e., wetlands), and aquatic organisms. Quartz Creek empties into the Taylor River approximately 1.5 miles below the Site and Taylor River joins the MFSR approximately 1 mile further downstream; therefore, only points above the confluence with the MFSR are considered targets because of the high flow rate and dilution of the MFSR compared to Quartz Creek. There are numerous primitive campsites located along the Taylor River above and below the confluence of Quartz Creek.

3.2.1.1 Local Surface Water Use

Plate 1 shows the 1 and 4-mile radius from the Site. Although there are no residences within a 4-mile radius of the Site, recreational use in the watershed is high. There is one water right within the 4-mile radius as shown on Plate 1. The water right, 0.01 cubic feet per second (cfs), is registered to the USFS on an unnamed tributary to the MFSR in Section 21 (T24 N, R10E). The water right was likely for the (former) Camp Brown Guard Station. Surface water uses were not field-verified as part of the SI; however; surface water in or around the Site is likely used for recreational purposes such as swimming, camping (washing dishes, cooking, and drinking water), and fishing. In addition, the Site is listed in *Discovering Washington's Historic Mines* (Northwest Underground Explorations, 1997) which states "there is plenty of good drinking water…at Quartz Creek".

3.2.1.2 Wetlands

Maps outlining designated wetland areas were prepared by the National Wetlands Inventory (NWI, 1995), a division of the U.S. Fish and Wildlife Service. The document was prepared primarily by analysis of high altitude aerial photographs. Wetlands were identified based on vegetation, visible hydrology, and geography in accordance with Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et. al., 1979). The following are considered "listed" on the NWI map (USFWS, 1994):

- Quartz Creek, from approximately 2 miles upstream of the Site to the confluence with the Taylor River, is identified as Riverine, Upper Perennial, Open Water, Intermittently Exposed/Permanent (R3OWZ);
- The Taylor River, downstream of the confluence with Quartz Creek is identified as R3OWZ;
- Areas located at the headwaters of a tributary of Quartz Creek, approximately 2 miles west of the Site, are designated as Palustrine, Open Water, Intermittently Exposed/Permanent (POWZ);
- Areas located approximately one mile north of the Site are classified as POWZ; and
- Areas in the vicinity of the confluence of Quartz Creek and the Taylor River are classified as Palustrine, Scrub-Shrub, Saturated/Semipermanent/Seasonal (PSSY) and Palustrine, Forested, Intermittently Flooded/Temporary (PFOW).

3.2.1.3 Aquatic Ecological Survey

Aquatic surveys were conducted in four stream reaches within Quartz Creek and two reaches within the Taylor River, to assess the potential effects of the Site on the instream habitat, benthic macroinvertebrate community, and presence of fish species due to the potential for site-related physical impacts or chemical contamination. Refer to Appendix D for supplemental text, figures and tables. The rare, threatened, or endangered (RTE) species known or expected to inhabit the area surrounding the Site are listed in Appendix D.

Overall instream physical habitat conditions (Barbour 1999) were optimal for all reaches although there were suboptimal, marginal, or poor ratings for some individual habitat parameters at different stations. Differences in invertebrate abundance in pool habitats generally suggest that pool habitat quality was higher in the upstream portions of Quartz Creek than in the lower portions or within the Taylor River. Invertebrate diversity and population indices provide some suggestion that stations in the downstream portion of Quartz Creek and the downstream Taylor River station may be slightly impacted by habitat-related or other impacts. However, the results were variable, and no clear indicators of Site related impacts were evident.

Results of the benthic invertebrate investigation in riffle habitats show that the highest numbers of invertebrates were present at stations QC-03 and QC-04. An increased diversity between the upstream station and the station adjacent to the Site suggests that riffle habitat quality increased between the two stations. However, the general trend of decreasing species diversity measures downstream of the Site suggests either that habitat quality is degrading or that other potential impacts are affecting invertebrates. When considered as a whole, the data suggest that invertebrates at QC-03 may be impacted by factors other than habitat quality. An increased invertebrate diversity in the Taylor River downstream of the confluence provides evidence that the Taylor River is not impacted by conditions in Quartz Creek.

No fish or fish passage barriers were noted in Quartz Creek. Through communications with regional biologists, the Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species Program (PHSP; See Appendix D), and the Washington Department of Natural Resources (WDNR) Natural Heritage Program (NHP; See Appendix D) it was documented that rainbow trout, a state priority species, are known to be present in the MFSR. In addition, cutthroat trout, a federal species of concern, have been documented to occur in Quartz Creek and the Taylor River; however, the documented locations were not reported.

3.2.2 Hydrologic Setting

The Site is bordered on the southwest by Quartz Creek (Plate 1 and Figure 1). According to the USGS 7½ minute quadrangle maps (USGS, 1989), the Quartz Creek watershed above the Site is 2,980 acres or 4.6 square miles (Plate 1). Quartz Creek originates approximately 14 miles upstream from the Site. Overland flow originating at the Site flows down the slope and across the wasterock piles and ultimately into Quartz Creek. Quartz Creek discharges into the Taylor River approximately 1.5 miles downstream from the Site. Taylor River flows southwest approximately 1 mile before reaching the MFSR, the MFSR flows west and south for approximately 15 miles before reaching the Town of Tanner.

The flow rates in Quartz Creek could not be safely measured at each station; however, measurements were made on June 27, 2004, at QC-02 (14.1 cfs) and QC-03 (16.1 cfs). Flows from the seeps at the base of the large wasterock pile (WR-1) averaged 0.3 gallons per minute (gpm). The unnamed drainage adjacent to Adit 1 was measured at approximately 1 gpm.

3.2.3 Site Inspection Analytical Results

This section presents the surface water, pore water, and stream sediment analytical results for the SI conducted at the Site. Aquatic sampling stations are shown on Figure 1, analytical results are tabulated in Tables 1, 2 and 3; the original laboratory reports are available in the USFS Project File. Changes to the sampling program were made during the field event after discussion and concurrence with the USFS representative and presented in a letter included in Appendix A. A complete report of the quality assurance / quality control (QA/QC) procedures and results is available in the USFS Project File. Field activities were conducted from June 26 through June 28, 2004; the reader is referred to the FOP (CES, 2004) for sampling procedure, protocols, and analyses.

A total of 16 water samples (10 surface water and 6 pore water) and 8 sediment samples were collected from pool substations in Quartz Creek, Taylor River, unnamed drainages and wasterock seeps during the SI field activities (Figures 1 and 2). Metals analyses, field parameters and wet chemistry results are presented in Tables 1, 2 and 3. The following table summarized the metal results for surface water, pore water, and sediment samples.

Summary of Surface Water, Pore Water, and Sediment Metals Results

SAMPLE TYPE	TABLE / SAMPLE ID	METALS EXCEEDING ONE OR MORE COMPARISON CRITERIA	TRENDS OBSERVED AND COMMENTS
Surface Water	**Table 1**	**Total Recoverable metals (µg/L)**	
Quartz Creek (Background)	QC-SW-1	Arsenic (1.1 B)	Arsenic and aluminum exceed lowest criteria
Unnamed drainage, upgradient of WR-1 (Background)	RM-BG-SW4	Aluminum (90 B)	
Quartz Creek adjacent to Adit 1	QC-SW-2	Arsenic (1.4 B)	Arsenic above background and lowest criteria
Quartz Creek downstream of WR-1	QC-SW-3	Aluminum (100 B) and arsenic (1.4 B)	Aluminum and arsenic detected above background concentration and lowest criteria.
Quartz Creek above confluence with Taylor River	QC-SW-4	Arsenic (1.1 B)	
West seep at base of WR-1	RM-Seep-SW1	Aluminum (1,260), arsenic (14.1), arsenic V (14.1 C), barium (8 B), cadmium (0.2 B), copper (687), iron (580), zinc (20 B)	All metals detected above background and lowest criteria. Copper concentration in east seep exceeds WA drinking water criterion (1,300 µg/L).
East seep at base of WR-1	RM-Seep SW2	Aluminum (2,890), arsenic (1.9 B), barium (14), cadmium (0.7), copper (2,020), lead (0.5 B), manganese (54), zinc (60)	
Unnamed drainage collected downgradient of WR-2	RM-AWR-SW3	Aluminum (110 B), arsenic (57.7), arsenic V (52.3 C), barium (4 B), copper (2.1 B)	Aluminum, arsenic and copper detected above background concentration and lowest criteria. Highest arsenic (total, III, and V) detected in surface water.
Pore Water	**Table 2**	**Total Dissolved Metals (µg/L)**	
Quartz Creek above confluence with Taylor River	RM-PW-4	Barium (4 B) and copper (1.9 B)	Barium and copper detected above background and lowest criteria
West seep at base of WR-1	RM-Seep PW1	Aluminum (1,320), barium (17), cadmium (0.5), copper (409), iron (9,360), lead (0.2 B), zinc (70)	All metals detected above background and lowest criteria.
East seep at base of WR-1	RM-Seep PW2	Arsenic V (28.42 C) and cadmium (0.2 B)	

Summary of Surface Water, Pore Water, and Sediment Metals Results (cont.)

Sediment	Table 3	Total Metals (mg/kg)	
Quartz Creek (Background)	QC-SS-1	Arsenic (9.5)	Arsenic exceeds lowest criteria
Quartz Creek adjacent to Adit 1	QC-SS-2	Arsenic (12.3)	Arsenic and copper exceed background concentration and lowest criteria
Quartz Creek downstream of WR-1	QC-SS-3	Arsenic (22.6) and copper (145)	
Quartz Creek above the confluence with Taylor River	QC-SS-4	Arsenic (15.3)	
West seep at base of WR-1	RM-Seep-SS-1	Arsenic (179), cadmium (1.27), copper (4,410), silver (4.79)	Arsenic, cadmium; copper and silver exceed background concentrations and lowest criteria
East seep at base of WR-1	RM-Seep-SS-2	Arsenic (205), cadmium (0.69), copper (2,620), mercury (0.19 B), and silver (33.9)	Arsenic, cadmium; copper, mercury and silver exceed background concentrations and lowest criteria

3.2.4 Surface Water Exposure Pathway Summary

Based on the information presented in this section, metals have been released into Quartz Creek from the Site, and appear to have impacted stream sediments, surface water and pore water. However, the Taylor River and MFSR do not appear to be impacted from the Site. Two seeps were observed at the base of WR-1 and form a marshy area adjacent to Quartz Creek. Concentrations of arsenic and copper are elevated in all media in the seep area, which appear to be hydraulically connected to Quartz Creek.

The benthic invertebrate riffle habitat survey results suggest that the number and diversity of invertebrates decrease at stations QC-03 and QC-04 downstream of the Site, indicating possible Site impacts. However, the pool habitats survey results do not provide any conclusive evidence that the Site is impacting pool habitats downstream of the Site. Two species of frogs and eggs were observed in the seep area during the SI field activities. Rainbow trout, a state priority species, are known to be present in the MFSR. In addition, cutthroat trout, a federal species of concern, have been documented to occur in Quartz Creek and the Taylor River.

The surface water pathway is complete for both human and ecological receptors and further assessment is warranted. Metals of concern are aluminum, arsenic (total and V), and copper. The conclusions presented are based on aquatic samples collected during high flow conditions. An additional sampling event is recommended to determine surface water, pore water and sediment concentrations during low flow. If budget allows, two additional background aquatic stations (with surface water, pore water, sediment samples) should be established in Quartz Creek to supplement the background data collected during the SI.

3.3 Soil Exposure Pathway

3.3.1 Targets

3.3.1.1 Local Use

There are no onsite workers or persons living within 200 feet of the Site; however, public use of the Site and vicinity is likely high, though public access records are not maintained. The Site is described in *Discovering Washington's Historic Mines* (Northwest Underground Explorations, 1997) which encourages public exploration of the Site. Access is currently not restricted by fencing, nor were any "No Trespassing" signs noted during the SI. In general, land uses in this area are limited primarily to recreational activities such as hiking, fishing, camping, and hunting, as well as some minerals prospecting. In addition, the claimant, Robert Jackson, who is also a teacher, stated he has brought his class of children up to the Site to search for mineral crystals in the wasterock.

3.3.1.2 Terrestrial Ecological Survey

Terrestrial habitats and animals that are present or likely at, and surrounding, the Site were documented during the ecological survey and via communication with regional biologists. Lists of RTE plants and animals likely or known to be present in the vicinity of the Site were obtained from the USFS, WDFW PHSP, and the WNHP (See Appendix B). Full results of the terrestrial ecological survey are provided in Appendix D.

The major plant communities identified at and surrounding the Site included a western hemlock forest community, a riparian community, and a disturbed mine community. The forest community canopy layer is dominated by western hemlock and silver fir with a shrub layer of snowberry, salmonberry, devil's club, and vine maple. The forest herbaceous layer is minimal and predominantly included moss. The riparian community has a sparse canopy layer, primarily consisting of western hemlock and red alder, a dense shrub layer dominated by vine maple and salmonberry, and a dense ground cover. The disturbed areas include wasterock piles or excavated gravelly soil and a roadway between the mine and processing areas, and support a moderate canopy layer of western hemlock and western red cedar, a sparse shrub layer of predominantly snowberry and Indian plum and herbaceous species including deer fern, bracken fern, bleeding heart and sedges. The natural forest and riparian vegetation has been disturbed at the Site. A full listing of the plant species documented during the survey is presented in Table D-3, none of which are RTE species.

Game trails were not clearly present, but deer tracks and pellets were noted, suggesting that blacktail deer are present on and near the Site. Roosevelt elk may inhabit the region surrounding the Site. Other mammals or mammal sign observed included, black bear and Douglas' tree squirrel. Townsend's big-eared bats, a state candidate species and federal species of concern, could inhabit the shaft, but have not been documented. Birds seen or heard during the bird survey or during other field work at the Site are listed in Appendix D. The Pileated woodpecker, a state candidate species, is the only expected RTE bird species to inhabit the Site. Other RTE bird species listed in Appendix D may inhabit the forest surrounding the Site, but are unlikely to forage in the disturbed area.

Invertebrates noted on and near the Site include black carpenter ants, small black flies, spiders, a banana slug, and a blackfoot tightcoil snail. The observed invertebrates are listed in Table D-4. No RTE invertebrate species are known to inhabit the Site vicinity. No reptiles were noted during the survey; amphibians observed included Cascades frog and a red-legged frog located in the seeps at the based of WR-1, and a tailed frog tadpole in Quartz Creek. Reptiles and amphibians likely to be present in the vicinity are listed in Appendix D. The spotted frog and western toad are RTE species that may be found in the vicinity of the Site, but are unlikely within the disturbed habitat.

3.3.2 Site Inspection Analytical Results

The following sections present the background soil, wasterock, and vegetation tissue analytical results for the Site. Sample locations soils, wasterock and tissue samples are shown on Figures 1 and 2. Analytical results for background soils are tabulated in Table 4 and wasterock in Tables 5 and 6. Vegetation tissue results are tabulated in Table 7. The complete laboratory analytical results and a discussion of QA/QC procedures and results are available in the USFS Project File. The reader is referred to the FOP (CES, 2004) for sampling procedure, protocols, and analyses.

The volume of the wasterock piles were estimated by measuring the base of the pile, height and slopes of sides and with the use of AutoCAD and the prismoidal formula. Based on these calculations, the total volume of wasterock and material is estimated at 2,000 CY in WR-1 and 25 CY in WR-2.

3.3.2.1 Background Soil, Site Soil, and Wasterock Metal / pH Chemistry Results

Background soil samples were collected from three locations upgradient of the Site to provide representative chemistry of undisturbed areas around the Site (Figure 3). Laboratory results are summarized in Table 4. A total of 9 surficial wasterock and soil samples were collected and submitted for laboratory analysis. Subsurface samples could not be collected because mechanized equipment could not access the steep slopes of the Site, and the size of the wasterock prevented hand auguring.

Laboratory pH data indicates that background soil is acidic with pH ranging from 4.4 su to 5.1 su; Site soil and wasterock were also acidic with pH ranging form 3.1 su to 5.0 su. The following tables summarized the metals results for background, soil, and wasterock samples at the Site. The table only outlines metals that exceeded at least one comparison criteria and the average background, and provides a brief comment on any trends observed.

Summary of Background Soil, Site Soil, and Wasterock Metals Results

SAMPLE TYPE	TABLE / SAMPLE ID	METALS EXCEEDING AT LEAST ONE CRITERIA	METALS EXCEEDING ONE CRITERIA AND AVERAGE BACKGROUND	TRENDS OBSERVED AND COMMENTS
Background Soil	**Table 4**	**Total metals (units in mg/kg)**		
	RM-BGS-1 RM-BGS-2 RM-BGS-3	Aluminum, arsenic, arsenic V, chromium, chromium VI, copper, lead, vanadium, zinc.	Not Applicable (NA)	NA
Site Soils				
Soil around mill foundations	RM-S1 RM-S2 RM-S3	Aluminum, antimony; arsenic, arsenic V, chromium, copper, iron, lead, mercury, selenium, silver, vanadium, and zinc.	Aluminum (26,200), antimony (5.3); arsenic (299), arsenic V (298.4 C), chromium (7), copper (1,660), iron (100,000), lead (79.6), mercury (0.11 B), selenium (10.2), silver (41.1), vanadium (33), and zinc (60).	Aluminum, chromium, lead, vanadium and zinc similar to or less than background. Antimony, arsenic, copper, iron, mercury, selenium and silver are above background and lowest criteria.
Wasterock	**Table 5**	**Total metals (units in mg/kg)**		
WR-1	RM-WR1-1 RM-WR1-2 RM-WR1-3 RM-WR1-4 RM-WR1-5	Aluminum, arsenic, arsenic V, chromium, copper, mercury, selenium, silver, vanadium, and zinc.	Aluminum (17,500); arsenic (222), arsenic V (221.7C), chromium (12B); copper (1,970), mercury (0.67); selenium (11.1); silver (41.3); vanadium (67) and zinc (69).	Aluminum, chromium, zinc concentrations similar to or lower than background. Arsenic, copper, mercury, selenium, silver vanadium higher than background and lowest criteria. Vanadium lower than background at WR-2
WR-2	RM-WR2-1	Aluminum, arsenic, arsenic III, arsenic V, chromium, copper, mercury, selenium, silver, vanadium, and zinc.	Aluminum (7,690), arsenic (15,800), arsenic III (28.08), arsenic V (15,772), chromium (2 B), copper (1,310), mercury (1.08), selenium (4.4), silver (15), vanadium (6.1) and zinc (<100).	

Notes: For multiple samples, the concentration listed is the highest detected concentration in the sample set. Concentrations listed are "total" concentrations, unless indicated (i.e., chromium VI, arsenic V, etc.)

3.3.2.2 Wasterock Acid Base Accounting Results

Five wasterock and two soil samples were analyzed for static acid based accounting (ABA) using the Modified Sobek Method to evaluate the acid generating potential (AGP) and acid neutralization potential (ANP). As shown in Table 5, the acid base potential (ABP) ranged from -10 to -36 t $CaCO_3$/Kt (ABP units are presented as tons of calcium carbonate needed to neutralize a kiloton of waste) and the neutralization potential ratio (NPR) ranged from 0.03 to 0.1. ABP is the result of the ANP minus the AGP; a negative ABP indicates that the acid generating potential is greater than the acid neutralization potential. The NPR is the ratio of the ANP divided by the AGP; typically ratios < 1 are acid generating and ratios >3 are not acid generating. Based on these results, wasterock and soil at the Site has a high potential to produce acid rock drainage (ARD).

3.3.2.3 Wasterock TCLP / SPLP Results

Five wasterock and two soil samples were submitted for the toxicity characterization leaching procedure (TCLP) and the synthetic precipitation leaching procedure (SPLP) for the eight Resource Conservation Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver). There are no applicable standards for SPLP; however, the results can be compared to RCRA TCLP disposal limits. None of the samples had TCLP or SPLP results in excess of the TCLP standard (Table 6) and all were several orders of magnitude below the limits.

3.3.2.4 Plant Tissue Analytical Results

Six vegetation samples, co-located with background soil and wasterock samples, were collected around the Site. Laboratory results are presented in Table 7 and shown on Figures 1 and 2. As the waste piles are not well vegetated, a reconnaissance was first performed to determine which species of plant was abundant and widespread enough for the sampling program, and one that would likely be foraged on by ecological receptors. Based on the reconnaissance, vine maple was selected. No stressed vegetation was observed during the SI field activities. Samples BG-V1, BG-V2, and BG-V3 were collected to represent background plant tissue concentrations at the same location as background soil sample locations (BGS-1, BGS-2, and BGS-3, respectively). Samples RM-BG-V1, RM-BG-V2, and RM-BG-V3 were collected to represent background plant tissue concentrations at the same location as background soil sample locations (RM-BGS-1, RM-BGS-2, and RM-BGS-3, respectively). Samples RM-V1, RM-V2, and RM-V3 were collected to represent wasterock plant tissue concentrations.

Comparison criteria do not exist for plant tissue concentrations; however, criteria do exist for soil concentrations that are used to assess impacts to plant growth and the subsequent exposure to wildlife receptors that forage on plants. These criteria are included under the wasterock discussion. Results indicate that arsenic and iron concentrations were higher in plant tissue growing on wasterock when compared to background. All other metals in wasterock plant tissue were equal to or below the background vegetation concentrations.

3.3.3 Soil Exposure Pathway Summary

Metal concentrations in background soils are elevated; seven metals are present at concentrations exceeding one or more comparison criteria. However, 14 metals were detected in waste rock and soil samples at concentrations exceeding both the average background soil concentration and one or more comparison criteria. In comparing wasterock concentrations to average background soil concentrations, arsenic (total, III and V), copper, and silver are the metals of concern.

Analyses of ABAs for wasterock and soil indicates the Site does have the potential to produce ARD. None of the samples analyzed exceeded the Ecology TCLP Dangerous Waste limit. Results of the vegetation sampling indicate that the concentrations of metals in vegetation growing on wasterock are generally similar to or less than background concentrations. Although there is slightly more arsenic and iron in vegetation growing on or near wasterock, the differences are minimal. Numerous federal and state RTE mammals, birds, and herpetiles have potential habitat in the vicinity of the Site, thus the potential exists that ecological receptors could be impacted.

The soil exposure pathway is considered complete for both human and ecological receptors, and a release of hazardous substances has been documented in this SI.

3.4 Air Exposure Pathway

3.4.1 Targets

The target distance for the air pathway has been defined as 1 and 4 miles from the Site. There are no homes within one mile or four miles of the Site. However, the area is very popular with recreational users and a campground exists on the Taylor River, approximately 1 mile east of the Site. Sensitive environments, including wetlands, which are located within 4 miles from the Site, are also outlined in Section 3.2.2.

3.4.2 Air Exposure Pathway Summary

Air samples were not collected as part of the field activities. Arsenic, and other metals were likely released to the air during processing (i.e., crushing, sorting). However, processing is currently not occurring at the Site and has not occurred for over 40 years. The most likely air pathway is due to inhalation of particulate matter. As with soil exposure, this pathway is considered complete because arsenic impacted soil and waste material is concentrated at the surface where human and ecological receptors could be exposed to particulate matter. Because the air pathway is linked to the soil exposure pathway, addressing and/or eliminating the soil exposure pathway will address the air exposure pathway. Therefore, further assessment of the air pathway is not recommended.

4.0 CONCLUSIONS

Groundwater Pathway

The groundwater pathway is incomplete because there are no wells or groundwater protection areas within a 4-miles radius of the Site. Therefore, further assessment is not recommended.

Surface Water Pathway

The surface water pathway is complete for both human and ecological receptors due to elevated concentrations of metals in stream sediments, surface water, and pore water and further assessment is warranted. High concentrations of metals are being discharged to Quartz Creek from the seeps emanating from WR-1. In addition, the unnamed drainage adjacent to Adit 1 flows across WR-2 and carries elevated concentrations of aluminum and arsenic into Quartz Creek. Arsenic concentrations in surface water, pore water, and sediment samples collected adjacent to the Site (Adit 1 and WR-1) were higher than background concentrations, indicating an impact from the Site.

Rainbow trout, a state priority species, are known to be present in the MFSR. In addition, cutthroat trout, a federal species of concern, have been documented to occur in Quartz Creek and the Taylor River. The benthic invertebrate survey results for riffle habitats suggest that the number and diversity of invertebrates decrease downstream of the Site indicating a decrease in water quality downstream from the Site. However, the results of for pool habitats, indicative of sediment quality, do not provide any conclusive evidence of mine-related impacts downstream of the Site.

Soil Pathway

The soil exposure pathway is complete for both human and ecological receptors, and a release of hazardous substances has been documented in this SI. This is based on concentrations of 14 metals in wasterock and soil exceeding both the average background soil concentration and the lowest comparison criteria. Arsenic (III, V, and total), copper, and silver appear to be the metals of concern. No samples exceeded the Ecology Dangerous Waste TCLP limit. Wasterock at the Site does have the potential to produce ARD. Onsite vegetation does not appear to be impacted by mining activities associated with the Site. No terrestrial RTE species were observed; however, several have the potential and are expected to habitat in the vicinity of the Site

Air Pathway

This pathway is complete because metal impacted soil and wasterock are concentrated at the surface where human and ecological receptors could be exposed. The most likely air pathway is due to inhalation of particulate matter. However, addressing and/or eliminating the soil exposure pathway will likely render the air exposure pathway incomplete. Therefore, further assessment of the air pathway is not recommended.

5.0 RECOMMENDATIONS

Based on the information gathered as part of the SI and presented in this report, CES recommends performing an Engineering Evaluation / Cost Analysis (EECA) at the Rainy Mine. Since the SI activities were performed while snowmelt was a considerable part of the stream flow, it is recommended that low flow sampling (i.e., fall) be conducted to assure a more complete water quality assessment. As part of the EECA, a risk assessment should be performed to assess the human and ecological impacts, establish removal cleanup standards, and assess if a removal action are warranted. Physical dangers (i.e., opened adits, collapsed shafts, etc.) should also be included as part of the EECA.

USFS Disclaimer: This abandoned mine/mill site was created under the General Mining Law of 1872 and is located solely on National Forest System (NFS) lands administered by the USDA Forest Service. The United States has taken the position and courts have held that the United States is not liable as an "owner" under CERCLA Section 107 for mine contamination left behind on NFS lands by miners operating under the 1872 Mining Law. Therefore, USDA Forest Service believes that this site should not be considered a "federal facility" within the meaning of CERCLA Section 120 and should not be listed on the Federal Agency Hazardous Waste Compliance Docket. Instead, this site should be included on EPA's CERCLIS database. Consistent with the June 24, 2003 OECA/FFEO "Policy on Listing Mixed Ownership Mine or Mill Sites Created as a Result of the General Mining Law of 1872 on the Federal Agency Hazardous Waste Compliance Docket," we respectfully request that the EPA Regional Docket Coordinator consult with the Forest Service and EPA Headquarters before making a determination to include this site on the Federal Agency Hazardous Waste Compliance Docket.

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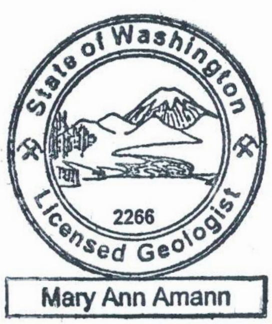

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TABLES

Table 1. Surface Water Analytical Results
Rainy Mine Site Inspection, Mt. Baker-Snoqualmie National Forest, King County, Washington

Results in µg/L

Sample I.D.	Sample Date	Aluminum, TR	Antimony, TR	Arsenic III, TR	Arsenic V, TR	Arsenic Total, TR	Barium, TR	Beryllium, TR	Cadmium, TR	Calcium, TR	Chromium III, TR	Chromium VI, TR	Chromium, TR	Cobalt, TR	Copper, TR	Iron, TR	Lead, TR	Magnesium, TR	Manganese, TR	Mercury, TR	Nickel, TR	Potassium, TR	Selenium, TR	Silver, TR	Sodium, TR	Thallium, TR	Vanadium, TR	Zinc, TR
QC-SW1	6/27/2004	80 B	< 0.2	0.192	0.908 C	**1.1 B**	< 3	< 2	< 0.1	1,200	< 10 C	< 1.0	< 10	< 10	< 0.5	< 10	< 0.1	< 200	< 5	0.00089	< 10	300 B	< 2	< 0.05	900 B	< 0.05	< 5	< 10
QC-SW2	6/27/2004	70 B	< 0.2	0.131	1.269 C	**1.4 B**	< 3	< 2	< 0.1	1,200	< 10 C	< 1.0	< 10	< 10	< 0.5	20 B	< 0.1	< 200	< 5	0.00091	< 10	< 300	< 2	< 0.05	900 B	< 0.05	< 5	< 10
QC-SW3	6/27/2004	**100 B**	< 0.2	0.117	1.283 C	**1.4 B**	< 3	< 2	< 0.1	1,200	< 10 C	< 1.0	< 10	< 10	1.1 B	10 B	< 0.1	< 200	< 5	0.00082	< 10	< 300	< 2	< 0.05	1,000 B	< 0.05	< 5	< 10
QC-SW4	6/26/2004	70 B	< 0.2	0.163	0.937 C	**1.1 B**	< 3	< 2	< 0.1	1,000	< 10 C	< 1.0	< 10	< 10	0.8 B	< 10	< 0.1	< 200	< 5	0.00089	< 10	< 300	< 2	< 0.05	900 B	< 0.05	< 5	< 10
TR-SW1	6/26/2004	50 B	< 0.2	0.069	< 0.431 C	< 0.5	< 3	< 2	< 0.1	1,200	< 10 C	< 1.0	< 10	< 10	< 0.5	< 10	< 0.1	< 200	< 5	0.00046	< 10	< 300	< 2	< 0.05	600 B	< 0.05	< 5	< 10
TR-SW2	6/26/2004	50 B	< 0.2	0.115	< 0.385 C	< 0.5	< 3	< 2	< 0.1	1,200	< 10 C	< 1.0	< 10	< 10	< 0.5	< 10	< 0.1	< 200	< 5	0.00053	< 10	< 300	< 2	< 0.05	700 B	< 0.05	< 5	< 10
RM-Seep-SW1	6/28/2004	**1,260**	< 0.2	0.044	**14.1 C**	**14.1**	**8 B**	< 2	**0.2** B	7,800	< 10 C	< 1.0	< 10	< 10	**687**	**580**	< 0.1	400 B	34	0.00065	< 10	500 B	< 2	< 0.05	3,200	< 0.05	< 5	**20 B**
RM-Seep-SW2	6/28/2004	**2,890**	< 0.2	< 0.007	1.893 C	**1.9 B**	**14**	< 2	**0.7**	6,700	< 10 C	< 1.0	< 10	< 10	**2,020**	150	**0.5 B**	600 B	**54**	0.00079	< 10	600 B	< 2	0.16 B	3,500	< 0.05	< 5	**60**
RM-AWR-SW-3	6/28/2004	**110 B**	< 0.2	5.43	**52.3 C**	**57.7**	**4 B**	< 2	< 0.1	7,600	< 10 C	< 1.0	< 10	< 10	**2.1 B**	30 B	< 0.1	300 B	< 5	0.00033	< 10	500 B	< 2	< 0.05	3,200	< 0.05	< 5	< 10
RM-BG-SW4	6/28/2004	**90 B**	< 0.2	0.043	< 0.457 C	< 0.5	< 3	< 2	< 0.1	1,300	< 10 C	< 1.0	< 10	< 10	< 0.5	20 B	< 0.1	< 200	< 5	NA	< 10	< 300	< 2	< 0.05	< 300	< 0.05	< 5	< 10
Standards, corrected for hardness where applicable (used 8.7 mg/L as average in surface water samples)																												
Washington - Aquatic Life [1]		NS	NS	NS	NS	*190*	NS	NS	0.17	NS	27.9	10	NS	NS	1.5	NS	0.14	NS	NS	0.012	32.2	NS	5	NS	NS	NS	NS	13.34
Washington - Human Health [2]		NS	14	NS	NS	0.018	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.14	610	NS	170	NS	NS	1.7	NS	NS
Washington Drinking Water Criteria [3]		NS	6	NS	NS	10	2,000	4	5	NS	NS	NS	100	NS	1,300	300	15	NS	50	2	100	NS	50	100	20,000	2	NS	50,000
EPA - Aquatic Life [4]		87	NS	NS	NS	*150*	NS	NS	*0.04*	NS	*11.6*	*11*	NS	NS	*1.2*	NS	*0.14*	NS	NS	*0.77*	*6.6*	NS	5	NS	NS	NS	NS	*15.09*
EPA - Human Health [5]		NS	5.6	NS	NS	0.018	NS	NS	NS	NS	NS	NS	NS	NS	1,300	NS	NS	NS	NS	NS	610	NS	170	100	NS	1.7	NS	7,400
ORNL - Surface Water PRGs [6]		87	30	190	3.1	NS	4	0.66	1.1	NS	210	11	NS	23	12	1,000	3.2	NS	120	*1.3*	160	NS	0.39	0.36	NS	9	20	110

Sample I.D.	Sample Date	Flow Rate (9/18/03)	Temperature (Field)	pH (Field)	pH (Lab)	Conductivity (Field)	Conductivity @ 25C (Lab)	Dissolved Oxygen (Field)	Oxygen Reduction Potential (Field)	Hardness as $CaCO_3$	Residue, Filterable (TDS) @180	Residue, Non- Filterable (TSS) @105 C	Sulfate
		cfs	°C	su	su	uS	uS	mg/L	mV	mg/L	mg/L	mg/L	mg/L
QC-SW1	6/27/2004	NM	13.4	6.3	6.4	10	12	12.1	210	3 B	< 10	< 5	20 B
QC-SW2	6/27/2004	14.1	12.9	6	6.6	10	17	12.49	215	3 B	< 10	< 5	10 B
QC-SW3	6/27/2004	16.4	12.1	6.1	6.5	10	12	12.75	213	3 B	40	< 5	< 10
QC-SW4	6/26/2004	NM	13.1	5.6	6.5	20	12	10.8	217	3 B	10 B	< 5	< 10
TR-SW1	6/26/2004	NM	13.4	6.0	6.5	10	11	11.8	244	3 B	< 10	< 5	< 10
TR-SW2	6/26/2004	NM	13.2	6.1	6.5	10	11	11.2	214	3 B	20	< 5	10 B
RM-Seep-SW1	6/28/2004	0.0007	7.5	5.5	6.7	70	69	10.50	153	21	60	< 5	20
RM-Seep-SW2	6/28/2004	0.0005	10.2	4.3	4.3	120	126	11.8	339	19	80	< 5	50
RM-AWR-SW3	6/28/2004	0.002	14.1	6.6	7.1	60	53	11.2	212	20	30	< 5	20 B
Above SW-AWR-SW3	6/28/2004	NM	13.8	6.7	NA	10	NA	11.5	126	NA	NA	NA	NA
Inside Adit Portal -west zone	6/28/2004	0	9.4	6.8	NA	90	NA	12.3	118	NA	NA	NA	NA
RM-BG-SW4	6/28/2004	NM	12.9	6.1	NA	10	NA	13.5	134	NA	NA	NA	NA
Standards													
Washington - Aquatic Life [1]		NS	12	6.5-8.5	6.5-8.5	NS	NS	9.5	NS	NS	NS	NS	NS
Washington - Human Health [2]		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Washington Drinking Water Criteria [3]		NS	NS	6.5-8.5	6.5-8.5	700	700	NS	NS	NS	500	NS	250
EPA - Aquatic Life [4]		NS	9-19	6.5-9	6.5-9	NS	NS	9.5	NS	NS	NS	NS	NS
EPA - Human Health [5]		NS	NS	5-9	5-9	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

All analyses except arsenic III & mercury were conducted by ACZ Laboratories, Inc., Steamboat Springs, CO per EPA Method 200 series
Arsenic III and mercury analyses were conducted by Brooks Rand, Seattle, WA per EPA Methods 1632 & 1631, respectively
Arsenic V was calculated from difference between Arsenic, TR and Arsenic III
Chromium VI was determined in the field using Hach Colormetric meter
Chromium III was calculated from difference between Chromium, TR and Chromium VI
mg/L = milligrams per liter
µg/L = micrograms per liter
cfs = cubic feet per second
su = standard units
µS = micro siemans
< value = analyte not detected above method detection limit (MDL)
C = concentration is an estimate based on calculation
B = analyte detected between MDL and practical quantification limit (PQL)
Bolded values indicate that the value exceeds one or more standard
NM - Not Measured
NA = Not analyzed

STANDARD NOTES:

1 - State of Washington Aquatic Life criteria (WAC 173-201A), underline - corrected for hardness, *italics* - expressed as dissolved
2 - State of Washington criteria for protection of human health (CLARC-Part IIIf)
3 - State of Washington drinking water criteria (WAC 246-290)
4 - EPA recommended chronic ambient water quality criteria for freshwater aquatic life used (EPA, 2002), underline - corrected for hardness, *italics* - expressed as dissolved
5 - EPA recommended ambient water quality criteria for protection of human consumption of water and fish (EPA, 2002 NTR)
6 - ORNL Preliminary Remediation Goals for Ecological Endpoints (ORNL, 1997)
NS = No Standard

Table 2. Pore Water Analytical Results
Rainy Mine Site Inspection, Mt. Baker-Snoqualmie National Forest, King County, Washington

Sample I.D.	Sample Date	Aluminum, Diss.	Antimony, Diss.	Arsenic III, Diss.	Arsenic V, Diss.	Arsenic, Diss.	Barium, Diss.	Beryllium, Diss.	Cadmium, Diss.	Calcium, Diss.	Chromium III, Diss.	Chromium V1, Diss.	Chromium, Diss.	Cobalt, Diss.
		Results in µg/L												
QC-PW-1	6/27/2004	50 B	< 0.2	0.186	0.91 C	1.1	< 3	< 2	< 0.1	1,200	< 10 C	< 1.0	< 10	< 10
QC-PW-2	6/27/2004	50 B	< 0.2	0.083	1.22 C	1.3	< 3	< 2	< 0.1	1,200	< 10 C	< 1.0	< 10	< 10
QC-PW-3	6/27/2004	40 B	< 0.2	0.051	1.35 C	1.4	< 3	< 2	< 0.1	1,200	< 10 C	< 1.0	< 10	< 10
QC-PW-4	6/26/2004	60 B	< 0.2	0.028	0.97 C	1	**4 B**	< 2	< 0.1	1,000	< 10 C	< 1.0	< 10	< 10
RM-Seep-PW1	6/28/2004	**1,320**	< 0.2	8.08	0.02 C	8.1	**17**	< 2	**0.5**	6,400	< 10 C	< 1.0	< 10	< 10
RM-Seep-PW2	6/28/2004	40 B	< 0.2	3.680	**28.42 C**	32.1	< 3	< 2	**0.2 B**	1,200	< 10 C	< 1.0	< 10	< 10
Standards, corrected for hardness where applicable (used 5.7 mg/L as average in pore water samples)														
Washington - Aquatic Life [1]		NS	NS	NS	NS	*190*	NS	NS	0.12	NS	19.7	10	NS	NS
EPA - Aquatic Life [2]		87	NS	NS	NS	*150*	NS	NS	*0.03*	NS	*8.6*	*11*	NS	NS
ORNL - Surface Water PRGs [3]		87	30	190	3.1	NS	4	0.66	1.1	NS	NS	NS	NS	23

Sample I.D.	Sample Date	Copper, Diss.	Iron, Diss.	Lead, Diss.	Magnesium, Diss.	Manganese, Diss.	Mercury, Diss.	Nickel, Diss.	Potassium, Diss.	Selenium, Diss.	Silver, Diss.	Sodium, Diss.	Thallium, Diss.	Vanadium, Diss.	Zinc, Diss.
		Results in µg/L													
QC-PW-1	6/27/2004	< 0.5	< 10	< 0.1	< 200	< 5	0.000795	< 10	< 300	< 0.1	< 0.05	1,000 B	0.20	< 5	< 10
QC-PW-2	6/27/2004	< 0.5	< 10	< 0.1	< 200	< 5	0.000877	< 10	< 300	< 0.1	< 0.05	1,000 B	0.18 B	< 5	< 10
QC-PW-3	6/27/2004	< 0.5	< 10	< 0.1	< 200	< 5	0.001770	< 10	< 300	< 0.1	< 0.05	1,000 B	0.08 B	< 5	< 10
QC-PW-4	6/26/2004	**1.9 B**	< 10	< 0.1	< 200	< 5	0.002860	< 10	< 300	< 0.1	< 0.05	1,000 B	0.05 B	< 5	< 10
RM-Seep-PW1	6/28/2004	**409**	**9,360**	**0.2 B**	600 B	60	0.001100	< 10	600 B	< 0.1	< 0.05	2,600	6.00	< 5	**70**
RM-Seep-PW2	6/28/2004	0.6 B	< 10	< 0.1	< 200	< 5	0.000134 B	< 10	< 300	< 0.1	< 0.05	1,000 B	< 0.10	< 5	< 10
Standards, corrected for hardness where applicable (used 5.7 mg/L as average in pore water samples)															
Washington - Aquatic Life [1]		1.0	NS	0.10	NS	NS	*0.012*	22.4	NS	5	NS	NS	NS	NS	9.18
EPA - Aquatic Life [2]		*0.8*	NS	*0.10*	NS	NS	*0.77*	*4.6*	NS	5	NS	NS	NS	NS	*10.38*
ORNL - Surface Water PRGs [3]		12	1,000	3.2	NS	120	1.3	160	NS	0.39	0.36	NS	9	20	110

Sample I.D.	Sample Date	Temperature (Field)	pH (Field)	pH (Lab)	Conductivity (Field)	Conductivity @ 25C (Lab)	Dissolved Oxygen (Field)	Oxygen Reduction Potential (Field)	Hardness as CaCO3	Residue, Filterable (TDS) @180	Sulfate	WAD Cyanide
		°C	su	su	µS/cm	µS/cm	mg/L	mV	mg/L	mg/L	mg/L	mg/L
QC-PW-1	6/27/04	14.5	6.8	6.5	10	13	12	195	3 B	20	< 10	< 0.01
QC-PW-2	6/27/04	14.1	6.6	6.1	20	13	12	210	3 B	20	20 B	NA
QC-PW-3	6/27/04	15.7	6.5	6.4	20	12	11	190	3 B	20	20 B	< 0.01
QC-PW-4	6/26/04	14.3	5.7	6.2	10	11	10	212	3 B	20	10 B	< 0.01
RM-Seep-PW1	6/28/04	20.5	5.3	5.6	100	86	7.9	152	19	70	40 B	NA
RM-Seep-PW2	6/28/04	15.7	4.4	4.6	120	106	5.6	-18	3 B	90	40 B	NA
Standards												
Washington - Aquatic Life [1]		12	6.5-8.5	6.5-8.5	NS	NS	9.5	NS	NS	NS	NS	5.2
EPA - Aquatic Life [2]		9-19	6.5-9	6.5-9	NS	NS	9.5	NS	NS	NS	NS	5.2

NOTES:

All analyses except arsenic III & mercury were conducted by ACZ Laboratories, Inc., Steamboat Springs, CO per EPA Method 200 series
Arsenic III and mercury analyses were conducted by Brooks Rand, Seattle, WA per EPA Methods 1632 & 1631, respectively
Arsenic V was calculated from difference between Arsenic, Diss. and Arsenic III
Chromium VI was determined in the field using Hach Colormetric meter
Chromium III was calculated from difference between Chromium, Diss. and Chromium VI
mg/L = milligrams per liter
µg/L = micrograms per liter
su = standard units
µS = micro siemans
< value = analyte not detected above method detection limit (MDL)
C = concentration is an estimate based on calculation
B = analyte detected between MDL and practical quantification limit (PQL)
Bolded values indicate that the value exceeds one or more standard
NM - Not Measured
NA = Not analyzed

STANDARD NOTES:

1 - State of Washington Aquatic Life criteria (WAC 173-201A), underline - corrected for hardness, *italics* - expressed as dissolved
2 - EPA recommended chronic ambient water quality criteria for freshwater aquatic life used (EPA, 2002), underline - corrected for hardness, *italics* - expressed as dissolved
3 - ORNL Preliminary Remediation Goals for Ecological Endpoints (ORNL, 1997)
NS = No Standard

Table 3. Sediment Analytical Results
Rainy Mine Site Inspection, Mt. Baker-Snoqualmie National Forest, King County, Washington

Sample ID	Sample Date	Aluminum, Total	Antimony, Total	Arsenic III, Inorganic	Arsenic V, Inorganic	Arsenic - Total	Barium, Total	Beryllium, Total	Cadmium, Total	Calcium, Total
		mg/kg								
QC-SS-1	6/27/2004	6,950	0.1 B	0.161	9.3 C	**9.5**	66.8	< 0.2	0.39	960
QC-SS-2	6/27/2004	7,550	< 0.1	0.098	12.2 C	**12.3**	61.6	< 0.2	0.22 B	1,490
QC-SS-3	6/27/2004	6,950	< 0.1	0.101	22.5 C	**22.6**	48.1	< 0.2	0.17 B	1,180
QC-SS-4	6/26/2004	5,750	0.2 B	0.137	15.2 C	**15.3**	36.8	< 0.2	0.14 B	1,590
TR-SS-1	6/26/2004	6,490	< 0.1	0.086	3.5 C	3.6	53.1	< 0.2	0.14 B	1,690
TR-SS-2	6/28/2004	6,790	< 0.1	0.068	5.3 C	5.4	44.1	< 0.2	0.12 B	1,920
RM-Seep-SS-1	6/28/2004	44,200	0.5 B	1.025	178.0 C	**179**	66.3	0.6 B	**1.27**	3,210
RM-Seep-SS-2	6/28/2004	19,500	< 2.0	3.342	201.7 C	**205**	63.1	< 0.2	**0.69**	2,360
Standards										
WA - Freshwater (under development) [1]		NS	0.6	NS	NS	51	NS	NS	1	NS
EPA - Freshwater TEL [2]		NS	NS	NS	NS	5.9	NS	NS	0.596	NS
EPA - Freshwater PEL [3]		NS	NS	NS	NS	17	NS	NS	3.53	NS
ORNL - Freshwater [4]		NS	NS	NS	NS	42	NS	NS	4.2	NS

Sample ID	Chromium, III, Inorganic	Chromium, V, Inorganic	Chromium, Total	Cobalt, Total	Copper, Total	Iron, Total	Lead, Total	Magnesium, Total	Manganese, Total	Mercury, Total	Nickel, Total	Potassium, Total	Selenium, Total	Silver, Total	Sodium, Total	Thallium, Total	Vanadium, Total	Zinc, Total
			mg/kg															
QC-SS-1	5.0 C	0.955	6	4 B	18	10,600	4.78	2770	181	< 0.04	2.7	1,670	< 0.5	0.04 B	130	0.11	23.9	31
QC-SS-2	3.1 C	0.936	4 B	4 B	27	9,540	4.97	2,540	184	< 0.04	2.3	1,300	< 0.5	0.06 B	230	0.09 B	20.5	31
QC-SS-3	5.2 C	0.764	6	3 B	**145**	9,700	3.6	2,390	135	< 0.04	2.4	1,090	< 0.5	0.28	190	0.07 B	17.7	30
QC-SS-4	2.2 C	0.765	3 B	3 B	30	8,150	3.12	2,110	152	< 0.04	1.6	1,350	< 0.5	0.09 B	250	0.09 B	17	23
TR-SS-1	2.2 C	0.786	3 B	4 B	19	12,100	7.4	3,270	216	< 0.04	3.8	1,750	< 0.5	0.13	190	0.13	22.6	40
TR-SS-2	3.2 C	0.823	4 B	3 B	16	10,500	3.48	2,990	189	< 0.04	3.1	1,510	< 0.5	0.08 B	280	0.11	20.3	30
RM-Seep-SS-1	8.4 C	2.573	11	8	**4,410**	23,300	27.2	3,150	167	< 0.05	7 B	1,420	0.8 B	**4.79**	220	0.23	39.9	82
RM-Seep-SS-2	9.9 C	1.119	11	4 B	**2,620**	49,700	31.2	5,100	198	**0.19 B**	7 B	1,330	7	**33.9**	320	0.18	50.2	90 B
Standards																		
WA - Freshwater (under development) [1]	NS	NS	100	NS	830	NS	430	NS	NS	0.75	70	NS	NS	2.5	NS	NS	NS	160
EPA - Freshwater TEL [2]	NS	NS	37.3	NS	35.7	NS	35	NS	NS	0.174	18	NS	NS	NS	NS	NS	NS	123.1
EPA - Freshwater PEL [3]	NS	NS	90	NS	197	NS	91.3	NS	NS	0.486	35.9	NS	NS	NS	NS	NS	NS	315
ORNL - Freshwater [4]	NS	NS	159	NS	77.7	NS	110	NS	NS	0.7	38.5	NS	NS	1.8	NS	NS	NS	270

Sample ID	Sample Date	Total Organic Carbon	Size Fraction by Hydrometer			Solids (ACZ)	Texture Classification	WAD Cyanide
			Clay	Sand	silt			
			%					mg/kg
QC-SS-1	6/27/2004	0.5	<0.1	97.5	2.5	81.2	S	<0.6
QC-SS-2	6/27/2004	2.2	<0.1	92.5	7.5	82.1	S	NA
QC-SS-3	6/27/2004	0.6	<0.1	97.5	2.5	92.6	S	<0.5
QC-SS-4	6/26/2004	0.2 B	<0.1	97.5	5	95.5	S	<0.5
TR-SS-1	6/26/2004	0.2 B	<0.1	100	2.5	93.4	S	NA
TR-SS-2	6/28/2004	0.2 B	<0.1	100	2.5	91.9	S	NA
RM-Seep-SS-1	6/28/2004	8.8	NA			13.0	NA	<4.0
RM-Seep-SS-2	6/28/2004	6.8	NA			37.5	NA	<1.0

NOTES:
Analysis (except AsIII) was conducted by ACZ Laboratories, Inc. in Steamboat Springs, CO, per EPA Method 6010/7000 series.
Arsenic III and chromium VI analyses were conducted by Brooks Rand, Seattle, WA per EPA Methods 1632 (arsenic) & 3060A & 7196A
Digestion (except AsIII) by EPA Method 3050B
mg/kg = milligrams per kilogram
< value = analyte not detected above Method Detection Limit (MDL, shown)
B = analyte detected between MDL and Practical Quantification Limit (PQL, not shown)
MDL and PQL are not consistent among samples
Arsenic V was calculated by subtracting Arsenic III from Total Arsenic
Chromium III was calculated by subtracting Chromium VI from Total Chromium
C = concentration is an estimate based on calculation
Bolded values indicate that the value exceeds one or more standard

STANDARD NOTES:
1 - State of Washington, Development of Freshwater Sediment Quality Values (DOE, Sept 2003)
2 - EPA Threshold Effects Level (NOAA, 1999)
3 - EPA Probable Effects Level (NOAA, 1999)
4 - ORNL ecological screening level values for freshwater, lowest chronic value used (ORNL, 1996)
NS = No Standard

Table 4. Background Soil Analytical Results
Rainy Mine Site Inspection, Mt. Baker-Snoqualmie National Forest, King County, Washington

Sample ID	Sample Date	Sample Depth (feet)	% Solids	pH	Aluminum, Total	Antimony, Total	Arsenic III, Total	Arsenic V, Total	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Calcium, Total	Chromium, Total	Chromium III, Total	Chromium VI, Total	Cobalt, Total	Copper, Total	Iron, Total	Lead, Total	Magnesium, Total	Manganese, Total	Mercury, Total	Nickel, Total	Potassium, Total	Selenium, Total	Silver, Total	Sodium, Total	Thallium, Total	Vanadium, Total	Zinc, Total
			%	su	mg/kg																										
RM-BGS-1	6/27/2004	0.5	66.7	4.4	**21,900**	0.1 B	0.534	**58.3** C	**58.8**	21.3	0.3 B	0.15 B	670	**5 B**	3.967 C	< 1.033	2 B	38.6	13,000	5.37	930	52.9	0.08 B	2.2	250	0.6 B	0.71	150	0.07 B	**24.1**	**13**
RM-BGS-2	6/27/2004	0.5	55.1	5.1	**23,800**	0.8	0.465	**26.5** C	**27**	47.9	0.2 B	0.25 B	1,490	**7**	5.946 C	< 1.054	4 B	**547**	19,500	**82**	1,620	196	0.08 B	7.1	550	0.5 B	0.43	160	0.1	**29.5**	**166**
RM-BGS-3	6/27/2004	0.5	66.4	4.9	**14,300**	0.2 B	0.235	7.5 C	**7.7**	14.1	< 0.2	0.14	670	**4 B**	NC	**27.055**	3 B	15	12,600	6.71	730	161	0.11 B	1.9	240	< 0.5	0.13	210	0.08 B	**25.5**	**12**
AVERAGE				4.8	20,000	0.37	0.411	30.8	31.2	28	0.2	0.18	943	5.3	4.96	9.4	3.0	200.2	15,033	31.4	1,093	137	0.090	3.7	347	0.45	0.42	173	0.083	26.4	64
Standards																															
WA - Method A Indust. Soil Cleanup Levels - Human Receptors[1]					NS	NS	NS	NS	20	NS	NS	2	NS	NS	2,000	19	NS	NS	NS	1,000	NS	NS	2	NS	NS	NS	NS	NS	NS	NS	NS
WA - Ecological Receptors (p=plant, b=soil biota, w=wildlife)[2]					50 p	5 p	7 w	10 p	NS	102 w	10 p	4 p	NS	42 bp	NS	NS	20 p	50 b	NS	50 p	NS	1,100 p	0.1 b	30 p	NS	0.3 w	2 p	NS	1 p	2 p	86 p
EPA Indust. PRGs - Human Receptors[3]					100,000	410	NS	NS	1.6	67,000	1,900	450	NS	450	100,000	64	1,900	41,000	100,000	800	NS	19,000	310	20,000	NS	5,100	5,100	NS	67	1,000	100,000
EPA - Ecological Receptors (m=mammal, b=bird, i = invertebrate, p=plant)[4]					NS	21 m	NS	NS	37 p	NS	NS	29 p	NS	5 p	NS	NS	32 b	61 i	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	120 i
ORNL - Ecological Receptors[5]					NS	5	NS	NS	9.9	283	10	4	NS	0.4	NS	NS	20	60	NS	40.5	NS	NS	0.00051	30	NS	0.21	2	NS	1	2	8.5

NOTES:
Analysis was conducted by ACZ Laboratories, Inc. in Steamboat Springs, CO using EPA Method 6000 Series & Method 7471.
Arsenic III and chromium VI analyses were conducted by Brooks Rand, Seattle, WA per EPA Methods 1632 (arsenic) & 3060A & 7196A (chromium VI)
mg/kg = milligrams per kilogram
su = standard units
< value = analyte not detected above indicated Method Detection Limit (MDL).
B = analyte detected between MDL and practical quantification limit (PQL).
NC = Not Calculated
Arsenic V was calculated by subtracting Arsenic III from Total Arsenic
Chromium III was calculated by subtracting Chromium VI from Total Chromium
C = concentration is an estimate based on calculation
Bolded values indicate that the value exceeds one or more standard
Average values calculated using one half the MDL if results were below the MDL.

STANDARD NOTES:
1 = Washington Department of Ecology MTCA (WAC 173-340) Industrial criteria, Table 745-1 (Ecology, 2001).
2 = Washington Department of Ecology MTCA (WAC 173-340) Industrial criteria, Table 749-2 (Ecology, 2001).
3 - EPA Region 9 Industrial Preliminary Remediation Goals - (EPA, 2002).
4 - EPA Ecological Soil Screening Levels - Lowest Criteria Listed (EPA, 2000)
5 - ORNL = Oak Ridge National Laboratory Preliminary Remediation Goals for Ecological Endpoints August 1997
NS = Not standard

Table 5. Waste Rock Analytical Results
Rainy Mine Site Inspection, Mt. Baker-Snoqualmie National Forest, King County, Washington

Sample ID	Sample Date	Sample Depth (feet)	% Solids (ACZ)	Paste pH	Aluminum, Total	Antimony, Total	Arsenic III, Inorganic	Arsenic V, Inorganic	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Calcium, Total	Chromium, Total	Chromium III, Total	Chromium VI, Total
			%	su	mg/kg											
RM-WR1-1	6/27/2004	0.5	79.8	3.1	**8,070**	1.6	0.281	**221.7** C	**222**	65	< 1	0.34	1,700	**10 B**	9.0 C	< 0.979
RM-WR1-2	6/28/2004	0.5	88.1	3.4	**15,500**	1.7	< 0.034	**48.7** C	**48.7**	70	< 1	0.27 B	3,000	**12 B**	11.2 C	< 0.794
RM-WR1-3	6/28/2004	0.5	81.8	3.9	**13,500**	1.6	0.207	**155.8** C	**156**	32.7	< 0.2	0.2	790	**7**	6.1 C	< 0.936
RM-WR1-4	6/28/2004	0.5	79.6	3.8	**7,660**	1.3	0.189	**128.8** C	**129**	37.9	< 0.2	0.22 B	660	**6**	5.0 C	0.983 B
RM-WR1-5	6/28/2004	0.5	81.5	4.1	**17,500**	0.4 B	0.253	**137.7** C	**138**	35.9	< 0.2	0.23	600	**7**	6.1 C	< 0.914
RM-WR2-1	6/28/2004	0.5	87.8	4.5	**7,690**	< **10**	**28.078**	**15,772** C	**15,800**	17.7	< 0.2	0.61	1,500	**2 B**	1.2 C	< 0.806
RM-S1	6/27/2004	0.5	86.5	3.3	**6,130**	**5.3**	0.598	**298.4** C	**299**	54.5	< 1	0.13 B	900	**5 B**	4.2 C	< 0.806
RM-S2	6/27/2004	0.5	74.9	4.9	**12,800**	1.2	0.081 B	**21.9** C	**22**	24.3	< 0.2	0.23 B	1,170	**7**	6.0 C	< 0.997
RM-S3	6/27/2004	0.5	64.0	5.0	**26,200**	0.9	0.425	**224.6** C	**225**	38.4	0.3 B	0.38	470	**6**	4.7 C	< 1.281
AVERAGE					12,783	2.1	3.35	1,890	1,893	41.8	0.26	0.3	1,199	6.9	5.9	0.53
Standards																
WA - Method A Indust. Soil Cleanup Levels - Human Receptors[1]					NS	NS	NS	NS	20	NS	NS	2	NS	NS	2,000	19
WA - Ecological Receptors (p=plant, b=soil biota, w=wildlife)[2]					50 p	5 p	7 w	10 p	NS	102 w	10 p	4 p	NS	42 bp	NS	NS
EPA Indust. PRGs - Human Receptors[3]					100,000	410	NS	NS	1.6	67,000	1,900	450	NS	450	100,000	64
EPA - Ecological Receptors (m=mammal, b=bird, i = invertebrate,					NS	21 m	NS	NS	37 p	NS	NS	29 p	NS	5 p	NS	NS
ORNL - Ecological Receptors[5]					NS	5	NS	NS	9.9	283	10	4	NS	0.4	NS	NS

Sample ID	Cobalt, Total	Copper, Total	Iron, Total	Lead, Total	Magnesium, Total	Manganese, Total	Mercury, Total	Nickel, Total	Potassium, Total	Selenium, Total	Silver, Total	Sodium, Total	Thallium, Total	Vanadium, Total	Zinc, Total	WAD Cyanide	Total Sulfur	ABAs: Acid Generation Potential	ABAs: Acid Neutralization Potential	ABAs: Acid-Base Potential
	mg/kg																%	t $CaCO_3$/Kt		
RM-WR1-1	< 5	**1,260**	70,400	14.5	4,700	149	**0.67**	3.7	2150	**7.6**	**29.5**	730	0.25	**49**	**39**	NA	1.14	36	<1	-36
RM-WR1-2	< 5	**1,970**	95,300	8.31	9,500	363	**0.1** B	4 B	4,160	**11.1**	**41.3**	1,860	0.2	**67**	**69**	NA	NA	NA	NA	NA
RM-WR1-3	3 B	**1,140**	40,100	22	3,270	142	**0.08** B	4 B	990	**3**	**12.5**	290	< 0.5	**32.2**	**50** B	<0.6	0.5	16	<1	-16
RM-WR1-4	2 B	**1,620**	47,900	13.7	3,600	158	**0.09** B	7	1,030	**4.8**	**18**	290	0.08 B	**26.7**	**50** B	NA	0.88	28	<1	-28
RM-WR1-5	3 B	**1,080**	24,100	7.2	2,410	112	**0.06** B	5.6	770	**1.6** B	**5.04**	160	0.11	**28.6**	**35**	NA	0.37	12	<1	-12
RM-WR2-1	10	**1,310**	47,100	40	1,990	190	**1.08**	< 10	470	**4.4**	**15**	410	< 3	**6.1**	< **100**	NA	0.75	23	<1	-22
RM-S1	< 5	**1,380**	**100,000**	**79.6**	3,600	159	**0.1** B	4 B	1,390	**10.2**	**41.1**	300	0.11	**33**	**30** B	NA	NA	NA	NA	NA
RM-S2	4 B	**986**	28,500	30.5	2,410	147	< **0.04**	7.5	710	**1** B	**3.62**	260	0.08 B	**23**	**60**	<0.6	0.38	12	<1	-12
RM-S3	3 B	**1,660**	27,500	12.6	2,500	129	**0.11** B	12	1,180	**5.3**	**28**	200	0.11	**22.3**	**50**	<0.7	0.31	10	<1	-10
AVERAGE	3.6	1,378	53,433	25	3,776	172	0.26	5.9	1,428	5.4	21.6	500	0.30	32.0	48	NC	0.62	NC	NC	NC
Standards																				
WA - Method A Indust. Soil Cleanup Levels - Human Receptors[1]	NS	NS	NS	1,000	NS	NS	2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
WA - Ecological Receptors (p=plant, b=soil biota, w=wildlife)[2]	20 p	50 b	NS	50 p	NS	1,100 p	0.1 b	30 p	NS	0.3 w	2 p	NS	1 p	2 p	86 p	NS	NS	NS	NS	NS
EPA Indust. PRGs - Human Receptors[3]	1,900	41,000	100,000	800	NS	19,000	310	20,000	NS	5,100	5,100	NS	67	1,000	100,000	NS	NS	NS	NS	NS
EPA - Ecological Receptors (m=mammal, b=bird, i = invertebrate,	32 b	61 i	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	120 i	NS	NS	NS	NS	NS
ORNL - Ecological Receptors[5]	20	60	NS	40.5	NS	NS	0.00051	30	NS	0.21	2	NS	1	2	8.5	NS	NS	NS	NS	NS

NOTES:
Analysis was conducted by ACZ Laboratories, Inc. in Steamboat Springs, CO using EPA Method 6000 Series & Method 7471.
Arsenic III and chromium VI analyses were conducted by Brooks Rand, Seattle, WA per EPA Methods 1632 (arsenic) & 3060A & 7196A (chromium VI)
mg/kg = milligrams per kilogram
t CaCO3/Kt = tons of calcium carbonate needed to neutralize 1000 tons of waste/soil. Negative number indicates lack of $CaCO_3$, positive value indicates excess (no need).
su = standard units
< value = analyte not detected above indicated Method Detection Limit (MDL).
B = analyte detected between MDL and practical quantification limit (PQL).
NA = not analyzed
NC = Not calculated
Arsenic V was calculated by subtracting Arsenic III from Total Arsenic
Chromium III was calculated by subtracting Chromium VI from Total Chromium
C = concentration is an estimate based on calculation
Bolded values indicate that the value exceeds one or more standard
Average values calculated using one half the MDL if results were below the MDL.

STANDARD NOTES:
1 = Washington Department of Ecology MTCA (WAC 173-340) Industrial criteria, Table 745-1 (Ecology, 2001).
2 = Washington Department of Ecology MTCA (WAC 173-340) Industrial criteria, Table 749-2 (Ecology, 2001).
3 - EPA Region 9 Industrial Preliminary Remediation Goals - (EPA, 2002).
4 - EPA Ecological Soil Screening Levels - Lowest Criteria Listed (EPA, 2000)
5 - ORNL = Oak Ridge National Laboratory Preliminary Remediation Goals for Ecological Endpoints August 1997
NS = Not standard

Table 6. Synthetic Precipitation Leaching Procedure and Toxicity Characteristics Leach Procedure Results for Waste Rock Samples. Rainy Mine Site Inspection, Mt. Baker-Snoqualmie National Forest, King County, Washington

Sample ID	Sample Date	Sample Depth (feet)	SPLP Arsenic	TCLP Arsenic	SPLP Barium	TCLP Barium	SPLP Cadmium	TCLP Cadmium	SPLP Chromium	TCLP Chromium	SPLP Lead	TCLP Lead	SPLP Mercury	TCLP Mercury	SPLP Selenium	TCLP Selenium	SPLP Silver	TCLP Silver
			mg/L															
RM-WR1-1	6/27/2004	0.5	< 0.04	< 0.04	0.023	0.014	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
RM-WR1-3	6/28/2004	0.5	< 0.04	< 0.04	0.012	0.053	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
RM-WR1-4	6/28/2004	0.5	< 0.04	< 0.04	0.026	0.031	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
RM-WR1-5	6/28/2004	0.5	< 0.04	< 0.04	0.052	0.123	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
RM-WR2-1	6/28/2004	0.5	0.50	0.61	0.005 B	0.051	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
RM-S2	6/27/2004	0.5	< 0.04	< 0.04	0.003 B	0.083	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
RM-S3	6/27/2004	0.5	< 0.04	< 0.04	0.021	0.062	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
Applicable Standards																		
RCRA TCLP Disposal Limits			5	5	100	100	1	1	5	5	5	5	0.2	0.2	1	1	5	5

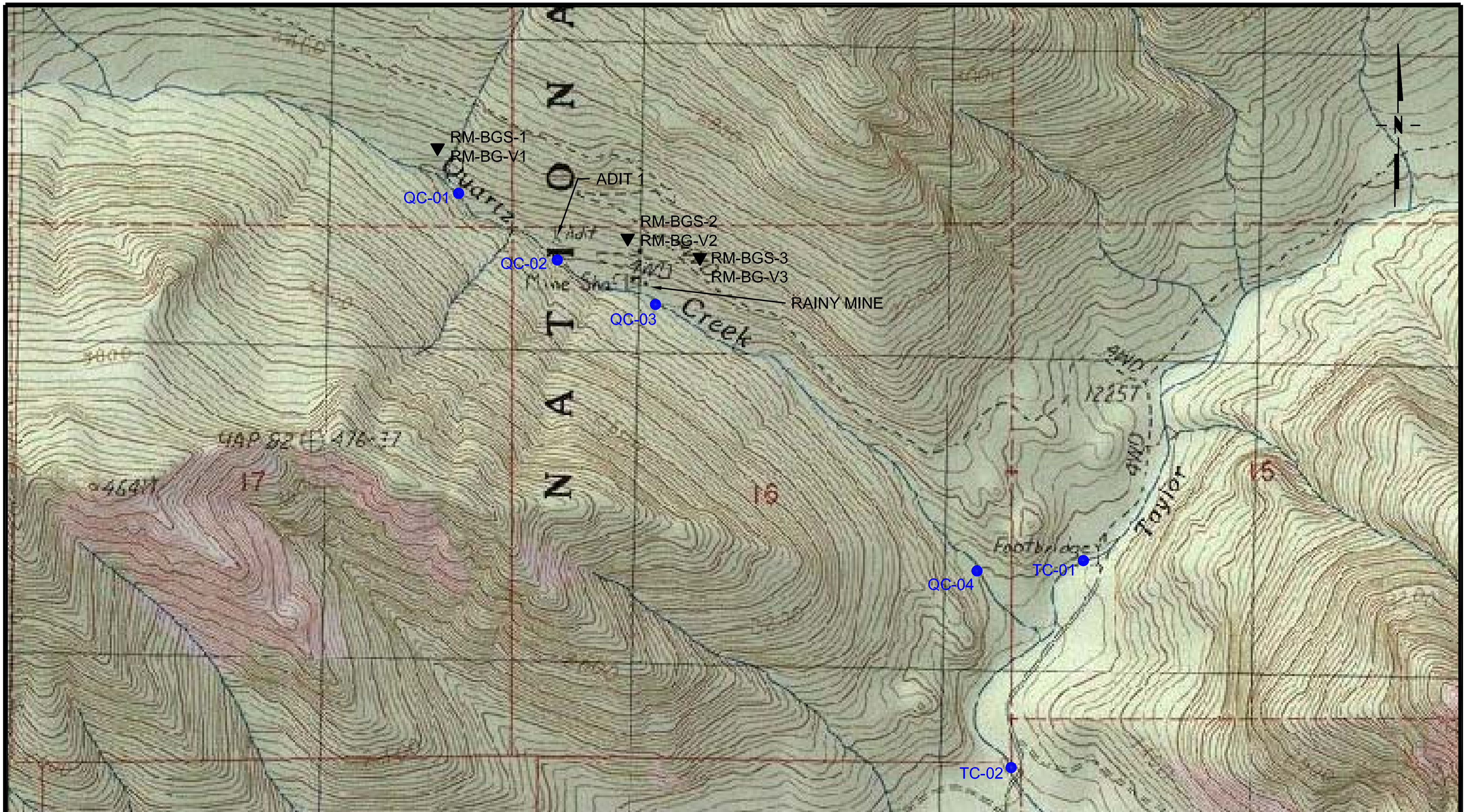
NOTES: Analysis was conducted by ACZ Laboratories, Inc. in Steamboat Springs, CO.
mg/L = milligrams per liter
< value = analyte not detected above method detection limit (MDL)
B = analyte detected between method detection limit (MDL) and practical quantification limit (PQL)

Table 7. Vegetation Analytical Results
Rainy Mine Site Inspection, Mt. Baker-Snoqualmie National Forest, King County, Washington

Sample ID	Sample Date	Onsite (O) or Background (B)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	WAD Cyanide
			mg/kg																							
RM-V1	06/27/04	O	36	< 0.1	0.3 B	17.5	< 0.2	0.12 B	7,800	< 1	< 1	13	124	0.19 B	2,410	382	< 0.1	< 1	10,100	< 0.5	< 0.03	< 30	< 0.03	< 0.5	62	< 0.9
RM-V2	06/27/04	O	31	< 0.1	0.8 B	23.8	< 0.2	0.13 B	8,790	< 1	< 1	12	93	0.26 B	2,660	447.0	< 0.1	1 B	11,400	< 0.5	< 0.03	< 30	< 0.03	< 0.5	84	NA
RM-V3	06/27/04	O	22	< 0.1	< 0.3	10.5	< 0.2	0.17 B	11,900	< 1	< 1	10	69	0.18 B	2,170	320	< 0.1	< 1	7,490	< 0.5	< 0.03	< 30	< 0.03	< 0.5	37	< 0.8
RM-BG-V1	06/27/04	B	29	< 0.1	< 0.3	26.1	< 0.2	0.05 B	8,300	< 1	< 1	12	73	0.16 B	2,260	382	< 0.1	1 B	9,150	< 0.5	< 0.03	< 30	0.12	< 0.5	36	< 1
RM-BG-V2	06/27/04	B	26	< 0.1	< 0.3	24	< 0.2	0.09 B	10,400	< 1	< 1	11	64	0.31	2,410	256	< 0.1	2 B	10,500	< 0.5	< 0.03	< 30	0.04 B	< 0.5	59	NA
RM-BG-V3	06/27/04	B	43	< 0.1	< 0.3	33.5	< 0.2	0.31	6,870	< 1	< 1	11	81	0.16 B	1,380	641	< 0.1	1 B	11,000	< 0.5	< 0.03	< 30	0.06 B	< 0.5	64	< 0.9

NOTES: Analysis was conducted by ACZ Laboratories, Inc. in Steamboat Springs, CO, per EPA Method 6010/7000 series.
Digestion by EPA Method 3050B
mg/kg = milligrams per kilogram
< value = analyte not detected above Method Detection Limit (MDL, shown)
B = analyte detected between MDL and Practical Quantification Limit (PQL, shown)
NA = not analyzed
PQL and MDL are consistent among samples

FIGURES



EXPLANATION

QC-01 Aquatic Sampling Station (Quartz Creek)

TC-02 Aquatic Sampling Station (Taylor Creek)

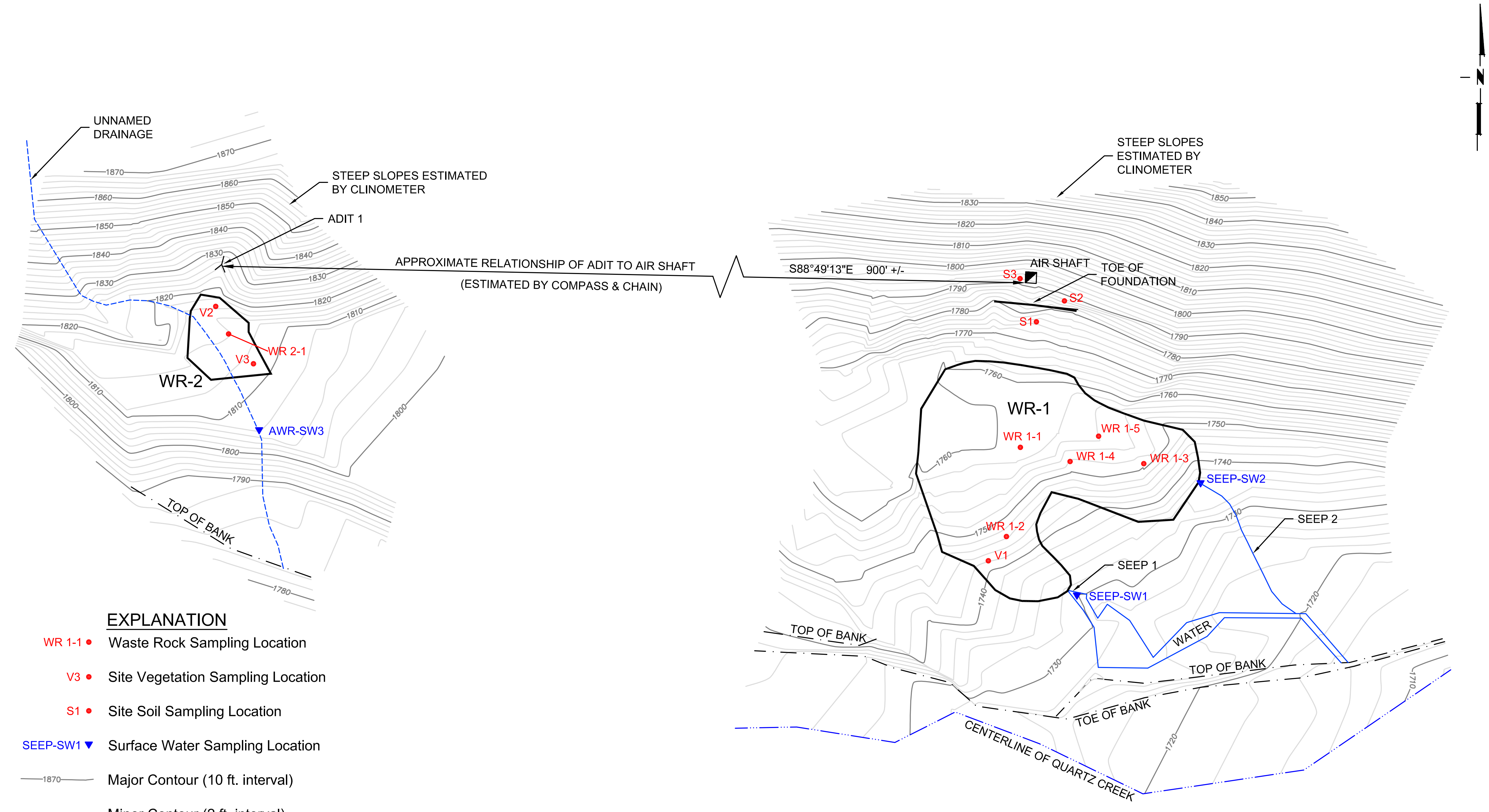
RM-B Background Soil Sample Location

0 1500 FEET

(SCALE & LOCATIONS ARE APPROXIMATE)

Figure 1. Aquatic and Background Sampling Stations

PROJECT NUMBER: 2423004	RAINY MINE SITE INSPECTION
DATE: 1/7/05	
DWG. 8DEO / DWG NO: 2423004-003P1.dwg	USDA FOREST SERVICE MT. BAKER / SNOQUALMIE NATIONAL FOREST NEAR NORTH BEND, WASHINGTON
PROJECT MANAGER: 6DGW	
REVISED: 5/20/05	CES CASCADE EARTH SCIENCES A Valmont Industries Company



EXPLANATION

- WR 1-1 ● Waste Rock Sampling Location
- V3 ● Site Vegetation Sampling Location
- S1 ● Site Soil Sampling Location
- SEEP-SW1 ▼ Surface Water Sampling Location
- —1870— Major Contour (10 ft. interval)
- Minor Contour (2 ft. interval)
- WR-2 Waste Rock Pile Outline & ID
- Open Adit
- Streams and Drainages (Ephemeral if Dashed)

NOTE:
The prefix "RM" (Rainy Mine) has been removed from the sample IDs.

0 50 FEET
(SCALE & LOCATIONS ARE APPROXIMATE)

Figure 2. Site Layout and Sampling Locations

PROJECT NUMBER: 2423004	RAINY MINE SITE INSPECTION
DATE: 1/14/05	
DWG BY 8DEO; DWG NO: 2423004-003P1.dwg	USDA FOREST SERVICE MT. BAKER / SNOQUALMIE NATIONAL FOREST NEAR NORTH BEND, WASHINGTON
PROJECT MANAGER: 6DGW	
REVISED: 5/20/05	CES CASCADE EARTH SCIENCES A Valmont Industries Company

PLATES

Plate 1 Rainy Mine Watershed Boundary with 1- and 4-mile radii

EXPLANATION

Watershed Boundary

Radius Surrounding Mine

Surface Water Rights Location

SCALE 1 INCH = 2,500 FEET

1 1/2 0 1 MILE

CONTOUR INTERVAL = 40 FT.

Plate 1. Rainy Mine Watershed Boundary with 1 and 4 Mile Radii

PROJECT NUMBER: 2423004		RAINY MINE SITE INSPECTION
DATE: 1/7/05		
DWG. 8DEO	DWG NO: 2423004-003P1.dwg	USDA FOREST SERVICE MT. BAKER / SNOQUALMIE NATIONAL FOREST NEAR NORTH BEND, WASHINGTON
PROJECT MANAGER: 6DGW		
REVISED:		CES CASCADE EARTH SCIENCES A Valmont Industries Company

APPENDICES

Appendix A.

Deviations from the Work Plan

CES
Natural Solutions for Water
A VALMONT INDUSTRIES COMPANY

Using natural systems to take the waste out of water

Phone: 509-921-1788 Fax: 509-921-1788
12720 E Nora, Suite A Spokane, WA 99216

September 11, 2004

Mr. Dennis Boles
Winema National Forest
2819 Dahlia
Klamath Falls, Oregon 97601

SUBJECT: CHANGES IN THE RAINY MINE SAMPLING AND ANALYSIS PLAN

Dear Dennis:

The following changes were made to the Sampling and Analysis Plan (SAP) for the Rainy Mine Site Inspection. These changes were made after field observations and after discussions with the USFS to confirm these changes.

- Pore water samples were not expected to be collected in the waste rock pile seeps below the shaft as it was assumed the seeps did not support aquatic life. However, after observing frogs and eggs in both seep pools, CES collected pore water and sediment samples from both seeps.
- USFS representative Greg Graham requested and authorized an additional background surface water sample to be collected from an unnamed drainage above the road leading to Rainy Mine. The sample was collected and analyzed for the 23 total recoverable metals only.
- Station QC-04 was removed from the sampling plan. Station QC-05 was renamed QC-04.
- Two surface water samples and two sediment samples were collected from Trout Creek at stations TC-01 and TC-02.
- Due to high water and boulder substrate, flow measurements could not be safely taken at TC-01, TC-02 and QC-01.
- Clay mineralization was planned for all "pool" sediment samples. However, because of the substrate size (i.e., minor amounts of clay) discovered during field activities, this analysis was deemed unnecessary and removed from the analysis list.
- A backhoe could not be brought into the Site because of the dense vegetation and narrow trail. Therefore since the wasterock piles could not be penetrated to a depth beyond 6 inches only surficial samples, 0-6 inches, were collected for analysis.

Please contact me at (509) 921-0290 if you have any questions.

Regards,
CASCADE EARTH SCIENCES

Dustin G. Wasley, PE
Managing Engineer

Appendix B.

Photographs

Photograph 1: View upstream at station QC-01. **CES 6/27/04**

Photograph 2: View downstream at Station QC-01. **CES 6/27/04**


Photograph 3: View upstream at station QC-02. **CES 6/27/04**


Photograph 4: View downstream at station QC-02. **CES 6/27/04**

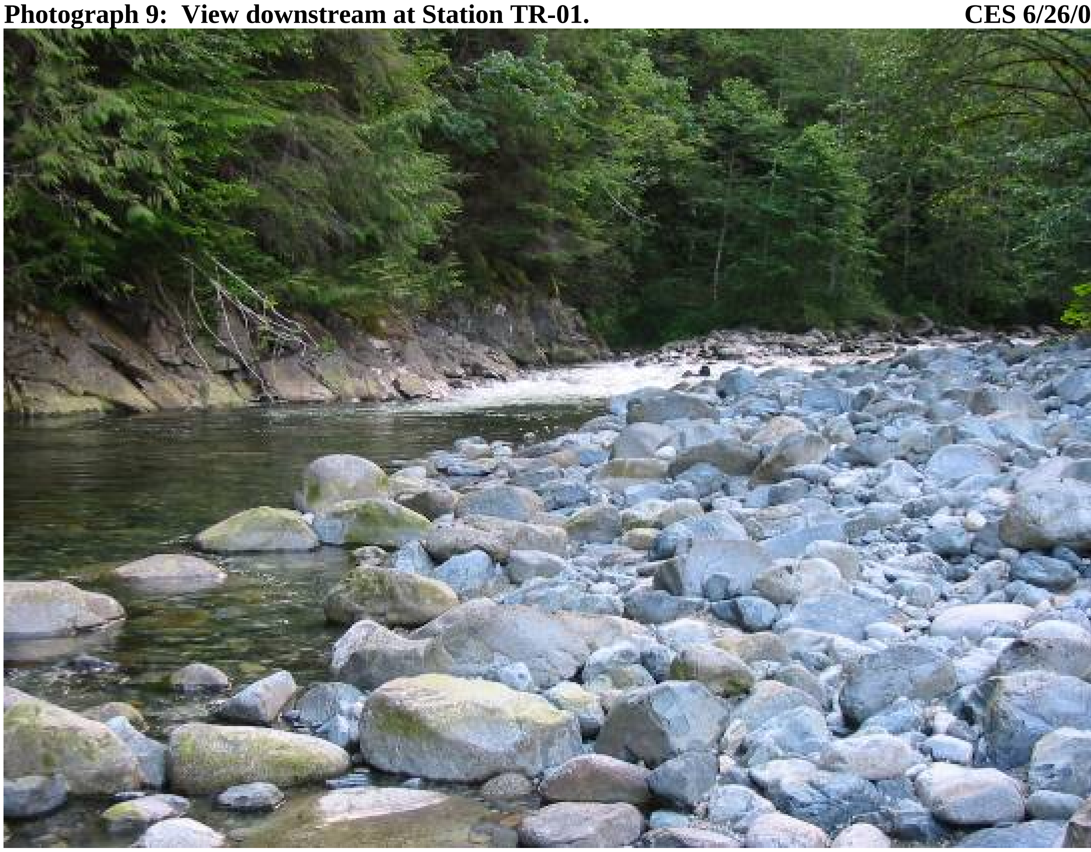
Photograph 5: View upstream at station QC-03. **CES 6/27/04**

Photograph 6: View downstream at station QC-03. **CES 6/27/04**

Photograph 7: View upstream at station QC-04. **CES 6/26/04**

Photograph 8: View upstream at Station TR-01. **CES 6/26/04**

Photograph 9: View downstream at Station TR-01. CES 6/26/04



Photograph 10: View upstream at Quartz Creek/Taylor River confluence at TR-02. CES 6/26/04

Photograph 11: View downstream at station TR-02 **CES 6/26/04**

Photograph 12: Close up of origination point of RM-Seep SW-1. **CES 6/28/04**

Photograph 13: View west at RM-seep SW-2 covered with green algae. CES 6/28/04

Photograph 14: View west of marshy area created by seeps. CES 6/28/04

Photograph 15: View north at unnamed drainage adjacent to west zone adit. CES 6/28/04

Photograph 16: View south at the unnamed drainage flowing over waste rock WP-2. CES 6/28/04

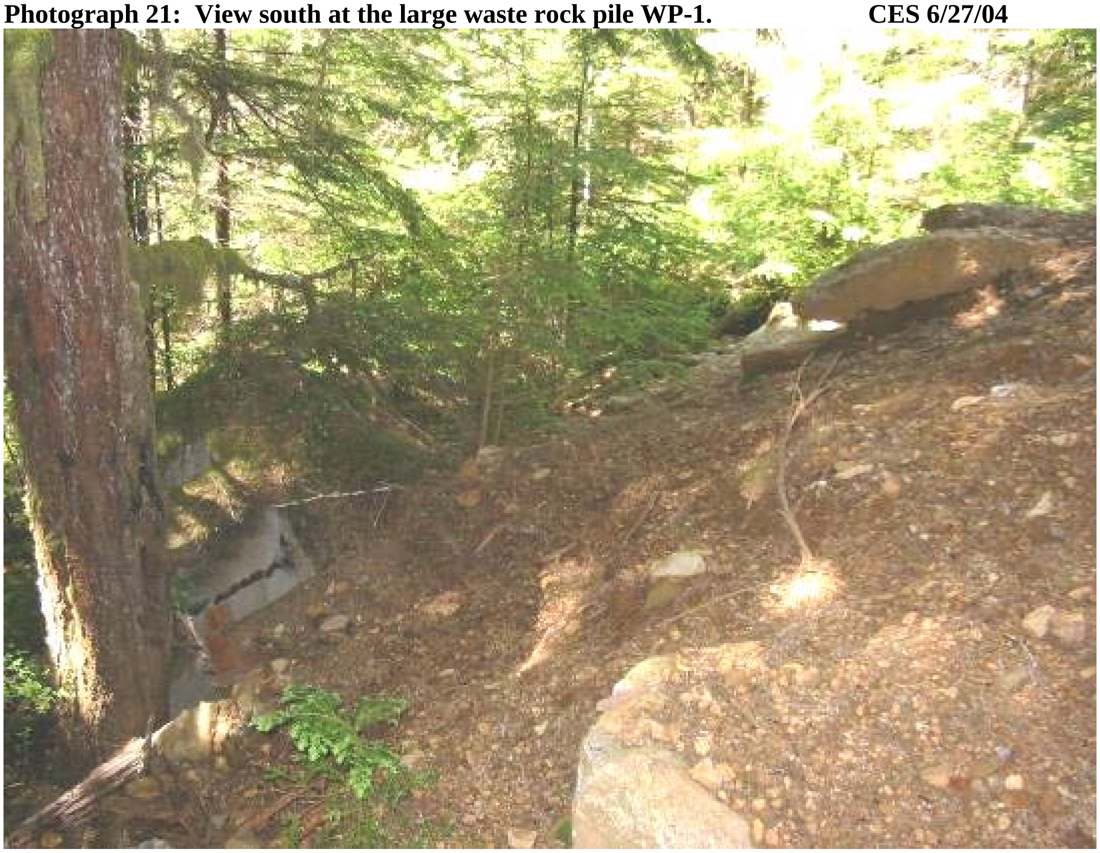

Photograph 17: Looking north at foundation and shaft in east zone workings. CES 6/27/04


Photograph 18: Looking southeast and downhill from area of shaft toward WP-1. CES 6/27/04

Photograph 19: Looking down into shaft at Rainy Mine. CES 6/27/04

Photograph 20: View west across waste pile WP-1 in east zone. CES 6/27/04


Photograph 21: View south at the large waste rock pile WP-1. CES 6/27/04


Photograph 21: Looking west near base of WP-1 southern slope. CES 6/27/04

Photograph 22: Large tank near southwest edge of WP-1 at base of slope. CES 6/27/04

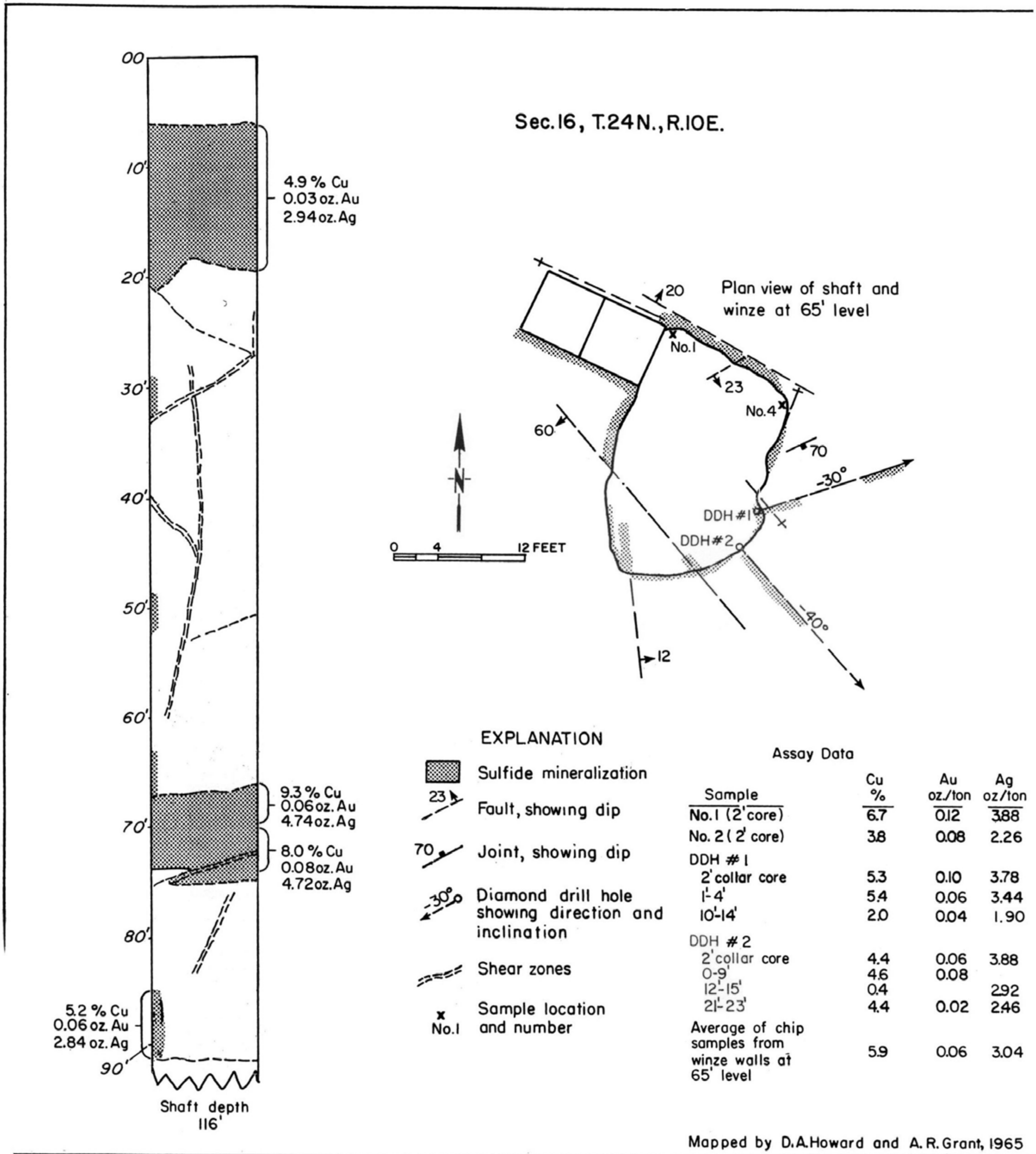
Photograph 23: Former mine ore cart at WP-1. CES 6/27/04

Photograph 24: View north toward open adit in west zone. **CES 6/27/04**

Photograph 25: WP-2 below west zone adit at Rainy Mine. **CES 6/27/04**

Appendix C.

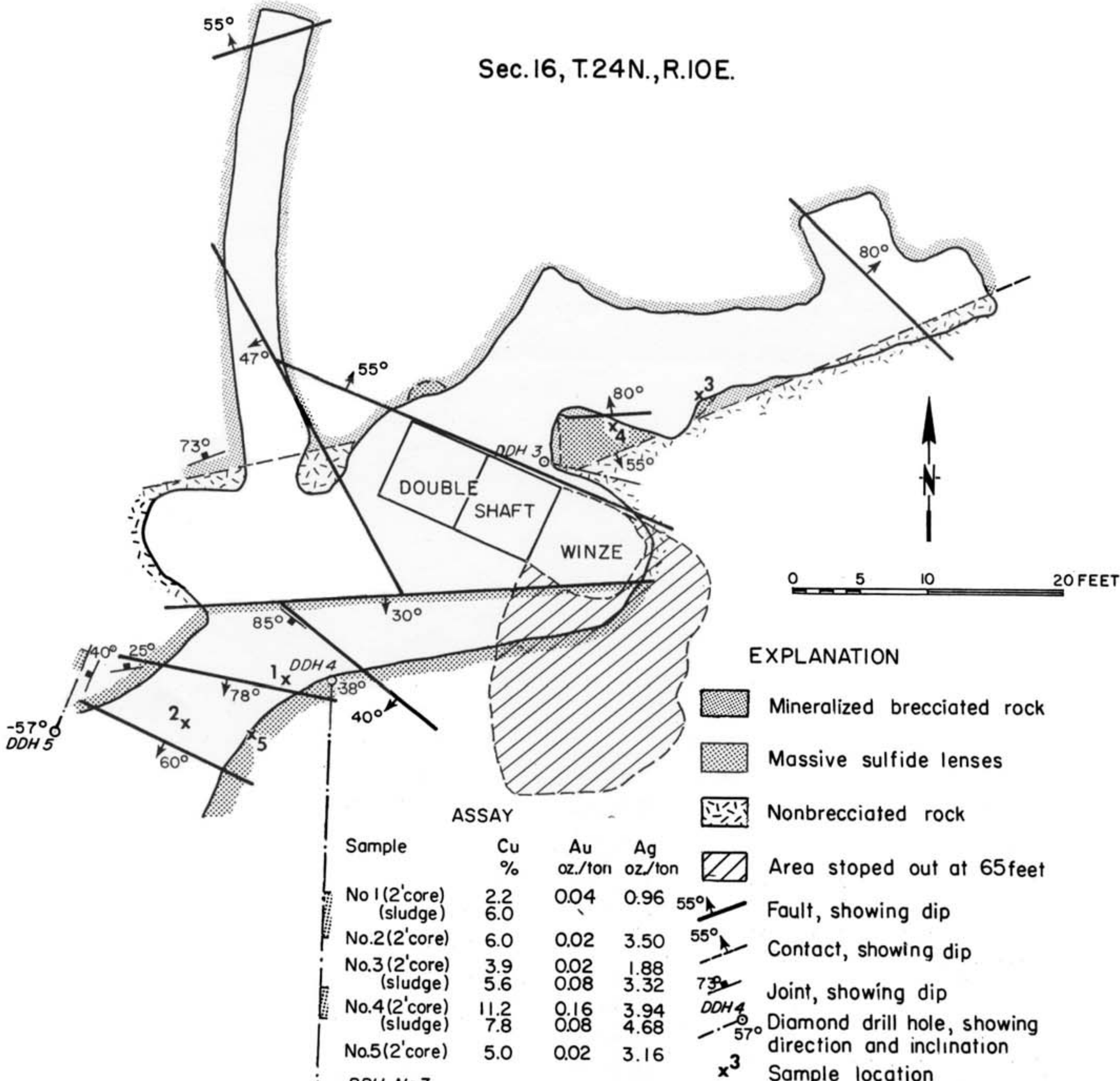
Mine Maps and Miscellaneous Information



Assay Data

Sample	Cu %	Au oz./ton	Ag oz/ton
No. 1 (2' core)	6.7	0.12	3.88
No. 2 (2' core)	3.8	0.08	2.26
DDH # 1			
2' collar core	5.3	0.10	3.78
1'-4'	5.4	0.06	3.44
10'-14'	2.0	0.04	1.90
DDH # 2			
2' collar core	4.4	0.06	3.88
0-9'	4.6	0.08	
12'-15'	0.4		2.92
21'-23'	4.4	0.02	2.46
Average of chip samples from winze walls at 65' level	5.9	0.06	3.04

FIGURE 99.—Plan and cross-section view of shaft in the east adit of the Quartz Creek property, Snoqualmie mining district, King County, Washington.



ASSAY

Sample	Cu %	Au oz./ton	Ag oz./ton
No 1 (2' core)	2.2	0.04	0.96
(sludge)	6.0		
No. 2 (2' core)	6.0	0.02	3.50
No. 3 (2' core)	3.9	0.02	1.88
(sludge)	5.6	0.08	3.32
No. 4 (2' core)	11.2	0.16	3.94
(sludge)	7.8	0.08	4.68
No. 5 (2' core)	5.0	0.02	3.16
DDH No. 3			
4'-10.5'	3.2	0.08	2.42
16'-18'	4.9		
29'-31'	0.4		
DDH No. 4			
20'-24'	3.2	tr.	2.2
29'-32'	0.7		
DDH No. 5			
0-9'	1.6		

Mapped by D. A. Howard and A. R. Grant, 1965

FIGURE 98.— East adit of the Quartz Creek property, Snoqualmie mining district, King County, Washington.

Appendix D.

Ecological Survey Tables and Figures

Aquatic Ecological Survey

Aquatic surveys were conducted within Quartz Creek and Taylor River to assess the potential impacts of the site on the instream habitat, benthic macroinvertebrate community, and presence of fish species due to the potential for site-related physical impacts or chemical contamination. In the vicinity of the Rainy Mine, Quartz Creek is a perennial first order stream (Armantrout 1998). At the time of our investigation, strong wadeable flow was found along the length of the stream with lower flow downstream near the confluence of Quartz Creek with the Taylor River, approximately one mile from the mine. Tables and Figures associated with the ecological survey are included in Appendix D.

Four stream reaches, each approximately 50 m long, were established on Quartz Creek with one reach (station Quartz Creek [QC]-01) upstream from the mine, one reach (station QC-02) adjacent to the mine, and two (stations QC-03 and QC-04) downstream of the mine. The stream reaches on the Taylor River were upstream (station Taylor River [TR]-01) and downstream (station TR-02) of the confluence of Quartz Creek with the river. Figure 1 and Plate 1 shows the locations of the stream sampling stations. Both riffle and pool habitats were sampled in each of the six selected stream reaches. Numeric habitat ratings were developed for each reach using USEPA Rapid Bioassessment Protocol - Habitat Assessment Field Data Sheets for High Gradient Streams (Barbour 1999). Additional instream characterization was conducted with the Physical Characterization Field Data Sheet (Barbour 1999). The following habitat conditions were noted:

- Habitat total scores were 170, 166, 180, 157, 170, and 193 at stations QC-01, QC-02, QC-03, QC-04, TR-01, and TR-02, respectively. This indicates the overall instream physical habitat conditions were optimal for the all stream reaches.
- At QC-01, the substrate and frequency of riffles were suboptimal and the velocity/depth regime was rated as marginal because only the fast/shallow and fast deep regimes were present.
- At QC-02, substrate and frequency of riffles were suboptimal. The velocity/depth regime was rated poor at this station due to the presence of only one (fast/shallow) regime.
- At QC-03, substrate, velocity/depth regime, and frequency of riffles were each rated as suboptimal.
- At QC-04, the substrate and channel flow status were suboptimal, the frequency of riffles was marginal, and the velocity/depth regime was poor.
- At TR-01, substrate and frequency of riffles were suboptimal, and the velocity/depth regime was rated as marginal.
- At TR-02, all habitat parameters were rated as optimal.

The general character of Quartz Creek is a steep cascading stream, with predominantly boulder substrate, within a steep walled canyon. Very large boulders of up to 4-meter (m) diameter were present at stations QC-01, QC-02, and QC-03, and somewhat smaller boulders (<1 m to 0.25 m) were present at station QC-04. In addition, the stream channel was well channelized at the upper three stations, and became braided in the vicinity of station QC-04, near the confluence of Quartz Creek with the Taylor River. A lower volume of water at station QC-04 was likely the result of stream water infiltrating the alluvial deposits surrounding the station. The riparian corridor was similar at the upstream three stations, but wider, flatter, and containing a higher percentage of shrubs at station QC-04.

Taylor River is a second order stream (Armantrout 1998), with several times the volume of Quartz Creek. The dominant character of the river is cascades. However, relatively high volume riffles and pools are present between the cascades. There was more cobble and gravel within the river compared to Quartz Creek. The banks of the river were not as steep as those of the upstream creek stations but were similar to station QC-04. Riparian vegetation along the river was also similar to station QC-04, but included the gravel forest road.

Sampling of benthic macroinvertebrates was conducted from each of the six stream reaches using a standard D-ring kick net with 500 micrometer mesh. Samples were collected from pool and riffle at all six stations. Three kick-net samples (i.e., jabs) from each pool and riffle sampling location were composited into one larger sample for a total area of approximately 0.6 square meters (m^2) sampled per habitat type per station. Laboratory enumeration was completed to the species level, when possible, for at least 300 individuals in each sample. Abundance, diversity, and several biological indices were examined for the invertebrates present in each pool and riffle sample, and qualitatively compared between stations. Pool data were only compared to other pool data and riffle data were only compared to other riffle data. The aquatic invertebrates identified during the investigation are listed in Table D-1.

The results of the benthic invertebrate investigation in pool habitats show that:

No rare, threatened, or endangered (RTE) invertebrate species were identified.

The numbers of all invertebrates were 435, 356, 579, 88, 154, and 84 at stations QC-01P, QC-02P, QC-03P, QC-04P, TR-01P, and TR-02P, respectively.

The number (i.e., abundance) of Diptera (primarily Chironomidae) was high at station QC-01P and decreased steadily along the length of Quartz Creek (Figure D-1). They remained low at station TR-01P and increased slightly again at station TR-02P. Conversely, Ephemeroptera, Plecoptera, and Trichoptera (i.e., EPT) numbers increased between stations QC-01P and QC-02P, dipped slightly at station QC-03P, then increased at each of the remaining stations. Oligochaete numbers were low and variable in Quartz Creek, increased at station TR-01P. There were very few other species present.

The total number of species (i.e., species diversity) increased from 27 to 39 between stations QC-01P and QC-02P, remained high at station QC-03P, then was lower and variable at stations QC-04P, TR-01P, and TR-02PP (Figure D-2). A lower than expected diversity of chironomid species was found at stations QC-04P and TR-01P.

The composition of functional feeding groups was variable, comprised predominantly of gatherers at stations QC-01P, QC-02P, TR-01P, and TR-02P, with both gatherers and predators dominant at stations QC-03P and QC-04P Figure D-3). Shredders were relatively high in number at station QC-02P, while scrapers were relatively high at station TR-01P. Filterers were consistently low in number across all stations. Clinger numbers decreased from stations QC-01P to QC-03P, increased at stations QC-04P and TR-01P, then decreased again at station TR-02P.

The metals tolerance index increased slightly between stations QC-01P and QC-03P, remained relatively high at station QC-04R, and then was lower at the two Taylor River stations (Figure C-4). The Shannon-Weaver species diversity index (log e) was similar across all the stations. Margalef’s richness increased between stations QC-01P and QC-02P, decreased at both stations QC-03P and QC-04P, and then increased slightly at stations TR-01P and TR-02P. The intolerant species index was higher than station QC-01P at all other stations, but was relatively low at stations QC-03P, QC-04P, and TR-02P.

Compared to stations QC-01P, QC-02P, and QC-03P, the total number of invertebrates was quite low at station QC-04P and TR-02P, and somewhat lower at station TR-01P. This suggests that pool habitat quality was higher in the upstream portions of Quartz Creek than in the lower portion of the creek or within the Taylor River upstream and downstream of the confluence of the creek with the river. The steady decrease in chironomid numbers and corresponding increase in EPT numbers shown in Figure D-1 suggests a trend of declining pool habitat quality proceeding downstream from the mine. Generally, the increase in EPT numbers, the decreasing pool habitat quality does not appear to be mine related. This is likely related to the cascading and scouring nature of the creek and river, which removes much of the fine grained materials from the stream channel. The upstream pool quality may have been better because the larger boulders create larger pools, resulting in the presence of a higher percentage of fine substrate. However, the decrease in numbers of both chironomid and EPT at station QC-03P contradicts the general trend and may indicate that habitat quality is not the only factor in the decreased number of invertebrates at this station.

The highest number of species present is at stations QC-02P and QC-03P, while the lowest numbers are at QC-04P (Figure C-2). Stream conditions at station QC-04P were notably different from all other stations and this may explain the differences. In addition, while the number of chironomid species decreased at station QC-04P, EPT species continued to increase at this station. Given that EPT species are often more sensitive indicators of chemical pollution, this suggests that the decrease in chironomid species may be related to declining pool habitat quality.

The variability in the functional group data (Figure D-3) disallows any clear inferences regarding potential mine-related or habitat-related impacts. The low percentage of most functional groups at station TR-02P may suggest some habitat or other impact at this location.

The metals tolerance indices and Margalef's richness indices suggest slight, but potential differences in invertebrate populations at stations QC-03P and QC-04P (Figure D-4). The intolerant taxa index suggests fewer than expected intolerant species are present at stations QC-03P, QC-04P, and TR-02P. However, the consistent Shannon-Weaver indices do not indicate an imbalance in the number of taxa at any station.

Generally, pool habitats are representative of instream sediment quality. The overall results of the benthic invertebrate survey for pool habitats do not provide any conclusive evidence of mine-related impact downstream of the Rainy Mine. However, some of the individual metrics and indices provide some suggestion that stations QC-03P, QC-04P, and TR-02P may be slightly affected by habitat-related or other impacts.

Results of the benthic invertebrate investigation in riffle habitats suggest that:

No RTE invertebrate species were identified.

The total numbers of invertebrates at each station were 167, 423, 492, 302, 25, and 253 at stations QC-01R, QC-02R, QC-03R, QC-04R, TR-01R, and TR-02R, respectively.

EPT species were the most abundant taxonomic group at all stations. The number of EPT invertebrates decreased between stations QC-01R and QC-02R, then slowly increased across the remaining stations (Figure D-5). Baetidae (a family within the order Ephemeroptera) numbers were low and essentially mirrored the distribution of EPT, except for the lack of Baetidae species at station TR-01R. Chironomid numbers increased between stations QC-01R, QC-02R, and QC-03R, then were noticeably fewer at the remaining three stations. Oligochaeta numbers were relatively low and variable, with the highest number at station QC-04R.

All of the measures of species diversity show an increase between stations QC-01R and QC-02R. Only chironomid species richness increased between station QC-02R and QC-03R, but then decreased at stations QC-04R and TR-01R. From station QC-02R, the richness of all species and non-chironomid/non-oligochaete species decrease consecutively until station TR-01R. EPT species richness increases between stations QC-03R and QC-04R, then also decrease substantially at TR-01R. All diversity measures increase between station TR-01R and TR-02R.

While overall species richness, non-Chironomid/non-Oligochaeta species richness and EPT richness decreased consecutively at stations QC-03R, QC-04R, and were lowest at station TR-01R (Figure D-6). EPT species richness showed a similar pattern, with a relatively lower number of species at station QC-03R. Chironomid species richness increased across the first three stations, decreased to a low at station TR-01R, then increased at station TR-02R.

The clinger functional groups decreased consecutively across the first four stations, then increased at the two Taylor River stations (Figure D-7). Gatherers showed a similar trend with a relatively higher number at station QC-02R. Predators decreased consecutively at stations QC-01R, QC-02R, and QC-03R, increased at stations QC-04R and TR-01R, then decreased dramatically at station TR-02R. Scrapers and shredder numbers varied across all stations, with a notable lack of scrapers and high number of shredders at station TR-01R. Filterers were variable, but highest at stations QC-03R, TR-01R, and TR-02R.

The metals tolerance index was low and consistent across all stations (Figure D-8). The Margalef's Richness index, Shannon-Weaver species diversity index (log e), and number of intolerant taxa varied somewhat between stations but overall showed an increase at station QC-02R, a decline between this station and station TR-01R, followed by increases at station TR-02R.

Decreasing EPT numbers and an increasing number of chironomids suggests a decrease in habitat quality across stations QC-01R, QC-02R, and QC-03R (Figure D-5). The very low number of invertebrates (25) at station TR-01R strongly suggests this station contained poor riffle habitat compared to the other stations.

The increased diversity between stations QC-01R and QC-02R suggests that riffle habitat quality increased between the two stations (Figure D-6). The general trend of decreasing species diversity measures between stations QC-02R and TR-01R suggests either that habitat quality is degrading or that other potential impacts are affecting stream invertebrates. Given that these locations are downstream of the Site, mine-related impacts cannot be ruled out. However, the diversity measures at stations QC-03R, and QC-04R are all similar to or greater than those at QC-01R, the reference condition, and are higher than noted at the Taylor River station upstream of the confluence of Quartz Creek with the river. Thus, any potential mine-related impacts are not reducing stream quality below that of reference conditions. The increased invertebrate diversity at station TR-02R, downstream of the confluence, provides some evidence that any impacts present within Quartz Creek riffle habitats are apparently not severely impacting the Taylor River.

Decreasing numbers of clingers, and to some lesser extent gatherers and shredders, between stations QC-01R and QC-04R, suggests decreasing riffle habitat quality or other impacts (Figure D7). Similar evidence is provided by decreased numbers of predators and scrapers between stations QC-01R and QC-03R, both of which show moderate increases at station QC-04R. Other than for clingers, the functional group data for station TR-01R is very different from all other stations with higher than expected numbers of predators and shredders, and lower than expected numbers of gatherers and scrapers. Conditions at station TR-02R are similar to other stations on Quartz Creek. Overall this suggests the potential for decreasing habitat quality or other impacts proceeding downstream along Quartz Creek.

The indices presented in Figure D-8 reflect much of the information presented in Figures D-5 through D-7. Decreasing Margalef's Richness and Shannon-Weaver indices and decreasing numbers of intolerant taxa suggest some evidence that invertebrate populations are being impacted proceeding downstream in Quartz Creek. The station with the most reduced invertebrate populations was TR-01R, which is in the Taylor River, upstream of any potential mine-related impacts.

Generally, riffle habitats are representative of instream water quality. Taken together, the riffle data suggest that the number of invertebrates and number of invertebrate species decrease downstream of the mine especially at stations QC-03R and QC-04R. The habitat score for reach QC-04 was the lowest of any other reach, but for reach QC-03 the habitat score was the best of the Quartz Creek stations. Thus it seems that habitat conditions may account for decreased invertebrates at station QC-04R, but not necessarily at Station QC-03R, which was directly downstream of the tailings processing area. The low numbers of invertebrates and invertebrate species at station TR-01R, upstream of the confluence of Quartz Creek and the Taylor River, are not readily apparent. The invertebrate populations appear to have recovered to more normal values at station TR-02R, downstream of the confluence of Quartz Creek with the river, suggesting that any invertebrate affects occurring within Quartz Creek are not noticeably reducing invertebrate populations within the Taylor River.

The potential presence of fish was documented by visual observation during the ecological survey. No fish were noted in Quartz Creek, but no barriers to fish passage were noted either. Through communications with regional biologists, the Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species Program (PHSP; See Appendix D), and the Washington Department of Natural Resources (WDNR) Natural Heritage Program (NHP; See Appendix D) it was documented that rainbow trout (*Oncorhynchus mykiss*), a state priority species, are known to be present in the Middle Fork of the Snoqualmie River, approximately 1 mile downstream of the confluence of Quartz Creek with the Taylor River. In addition, cutthroat trout (O*ncorhynchus clarki lewisi*), a federal species of concern, have been documented to occur in Quartz Creek and the Taylor River. The documented locations these fish within the creek and river were not reported.

Terrestrial Ecological Survey

Terrestrial habitats and animals that are present or likely at, and surrounding, the mine were documented during the ecological survey and via communication with regional biologists. Birds were identified opportunistically throughout the survey. A majority of plants were identified across each identified major vegetative community (i.e., habitat type). Qualitative surveys were conducted at and surrounding the mine for mammal and invertebrate presence and use. Lists of rare, threatened, or endangered (RTE) plants and animals likely or known to be present in the vicinity of the Site were obtained from the USFS, the PHSP, and/or the NHP. Table and Figures referenced in this section are included in Appendix D. The terrestrial RTE species potentially present within the area of the mine are listed in Table D-2.

The Site is within the Cascades Mixed Forest ecoregion (Bailey 1995). This ecoregion is characterized by warm summers and wet mild winters, with 30 to 150 inches of precipitation per year. Precipitation is common throughout the year, but a majority occurs in the fall, winter, and spring. Humidity is often high due to the proximity of this province to the Pacific Ocean. The dominant plant communities in this ecoregion may be Douglas fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), grand fir (*Abies grandis*), silver fir (*Abies amabilis*), or Sitka spruce (*Picea sitchensis*) forests at middle to low elevations. Western hemlock and silver fir are often the climax species.

The Site is encompassed by mature second growth coniferous forest. The major plant communities identified at and surrounding the mine included a western hemlock forest community, a riparian community, and a disturbed mine community.

The forest community canopy layer is dominated by western hemlock and silver fir. The forest shrub layer includes snowberry (*Symphoricarpos albus*), salmonberry (*Rubus spectabilis*), devil’s club (*Oplopanax horridus*), and vine maple (*Acer circinatum*). The herbaceous layer is minimal and predominantly included moss (*Climacium dendroides*). These species observed in the forest community are listed in Table D-3.

The riparian community has a sparse canopy layer, primarily consisting of western hemlock and red alder (*alnus rubra*). The shrub layer is dense, dominated by vine maple (*Acer circinatum*) and salmonberry (*Rubus spectabilis*). The ground cover (herbaceous layer) includes numerous species but is not dominated by any particular species. The plant species observed in the riparian community are listed in Table D-3.

The disturbed mine areas include waste rock or excavated gravelly soil and a roadway between the mine and processing areas. Western hemlock and western red cedar (*Thuja plicata*) are present in the moderate canopy layer. Snowberry and Indian plum (*Oemlaria cerasiformis*) are the dominant shrub species. Other common species include deer fern (*Blechnam spicant*), bracken fern (*Pteridium aquilinum*), bleeding heart (*Dicentra formosa*) and sedges (*Carex* sp.). These and other species observed in the disturbed mine community are listed in Table D-3.

The Site is primarily within the forested community and immediately adjacent to the riparian community. The vegetation within close proximity to the mine is a successional mix the forest and riparian communities. There is some evidence that the riparian community is also disturbed by past activities near the mine. However, the presence of moisture and relatively rich soils has allowed the development of a dense successional community of plants on the disturbed mine area. The waste rock at the processing area is barren. None of the identified plants were RTE species.

Invertebrates noted on and near the mine include black carpenter ants (*Camponotus pennsylvanicus*), small black flies (*Simulium* sp.), spiders (Order *Araneae*), a banana slug (*Ariolimax columbianus*), and a blackfoot tightcoil snail (*Pristiloma chirstenella*). The observed invertebrates are listed in Table D-4. No RTE invertebrate species are known to inhabit the mine vicinity.

Birds seen or heard during the bird survey or during other field work at the Site are listed in Table D-5. A majority of these birds were identified by their song or call. They represent an assemblage common among coniferous forests and associated riparian corridors. As noted in Table D-2, pileated woodpecker is the only observed or expected RTE bird species and is a state candidate for listing as a threatened or endangered species. The other RTE bird species listed in Table D-2 may inhabit the forest surrounding the mine, but are unlikely to forage in the disturbed mine area.

Game trails were not clearly present, but deer tracks and pellets were noted, suggesting that blacktail deer (*Odocoileus hemionus columbianus*) are present near the mines. Roosevelt elk (*Cervus elaphus roosevelti*) may inhabit the region surrounding the mine. Other mammals or mammal sign observed included, black bear (*Ursus americanus*) and Douglas' tree squirrel (*Tamiasciurus douglasii*). Townsend's big-eared bats (*Plecotus townsendi*), a state candidate species and federal species of concern, could inhabit the mine shaft but have not been documented. Other RTE mammal species that may inhabit the region, but are unlikely or uncommon at the mine site, are listed in Table D-2.

No reptiles were noted during the survey. Amphibians observed included Cascades frog (*Rana cascadae*) and a red-legged frog (*Rana cascadae*) in mine seeps, and a tailed frog tadpole in Quartz Creek (*Ascaphus montanusi*). Others potential present in the mine vicinity are listed in Table D-7. The spotted frog (*Rana pretiosa*) and western toad (*Bufo boreas*) are RTE species (Table D-2) that may be found in the vicinity of the mine but are unlikely within the disturbed mine habitat.

The presence of several vegetation/habitat communities and the associated edge habitats between these communities results in a diversity of wildlife. The riparian community immediately downgradient of the processing area includes a series of seeps where two species of frogs were observed. This seep area and the exposed waste rock provide the highest potential for mine-related affects to ecological receptors.

Figure D-1
Community Composition In Pool Habitats
Rainy Mine; North Bend, Washington

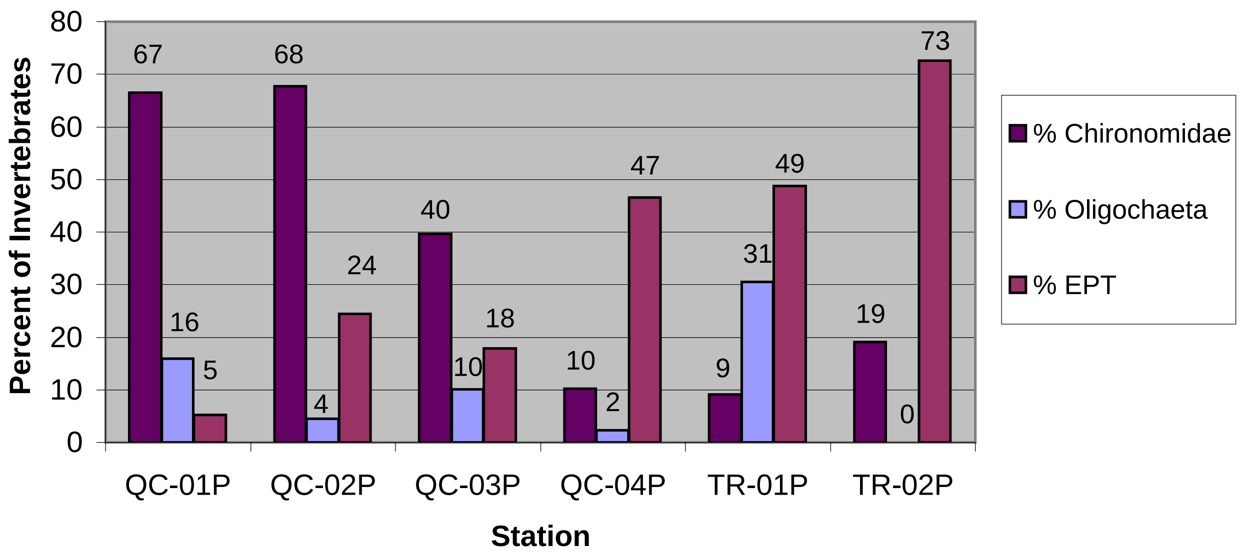


Figure D-2
Species Diversity In Pool Habitats
Rainy Mine; North Bend, Washington

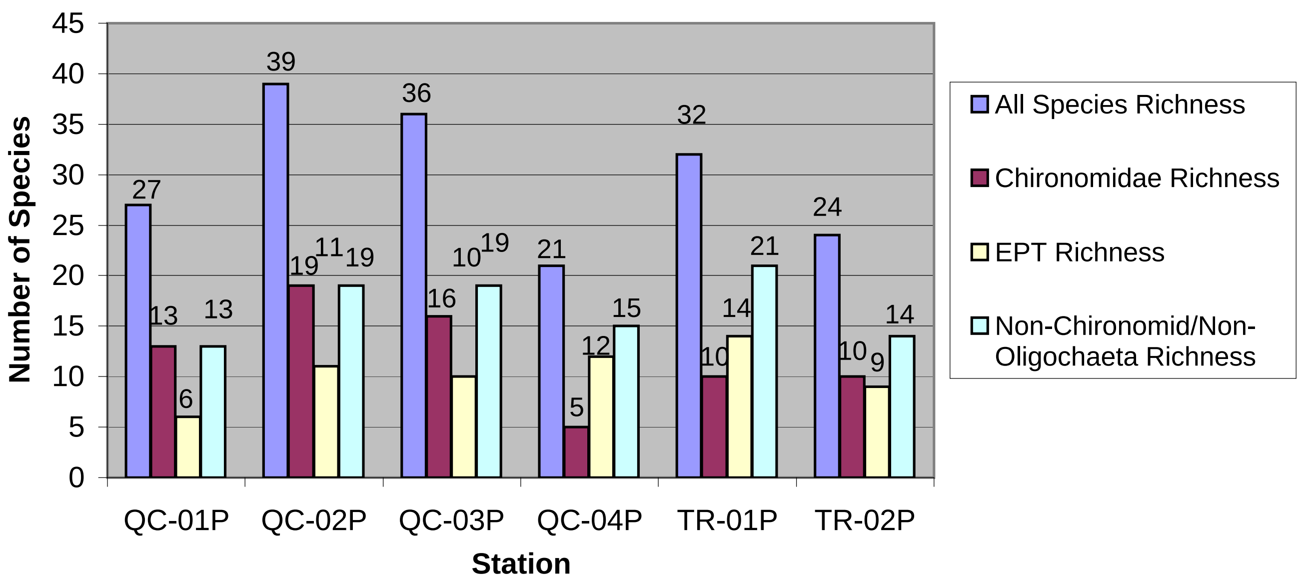


Figure D-3
Functional Group Composition In Pool Habitats
Rainy Mine; North Bend, Washington

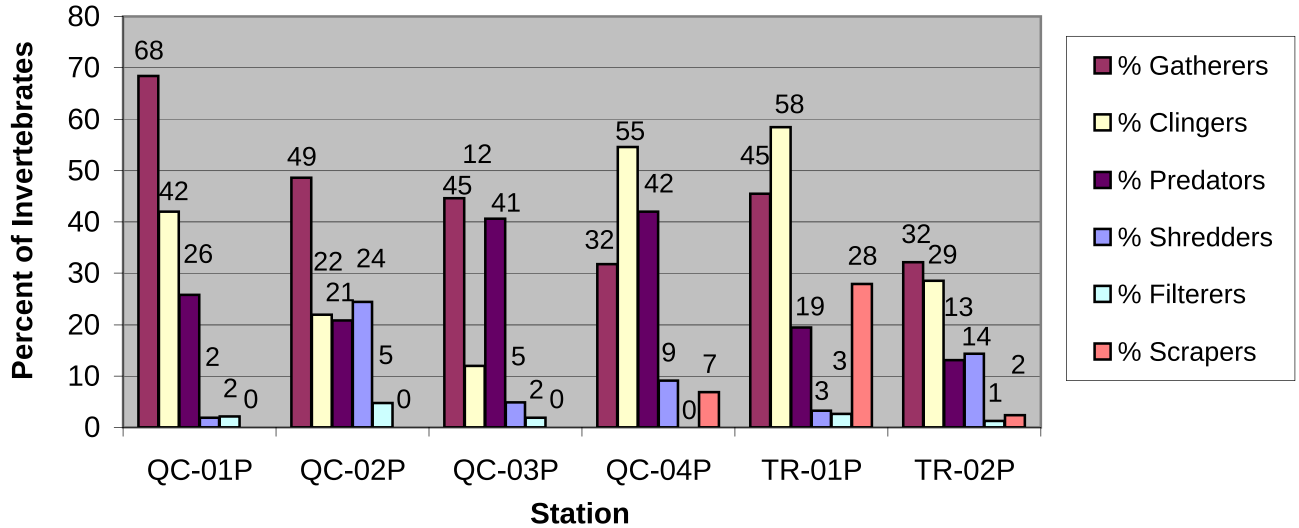


Figure D-4
Biological Indices for Pool Habitats
Rainy Mine; North Bend, Washington

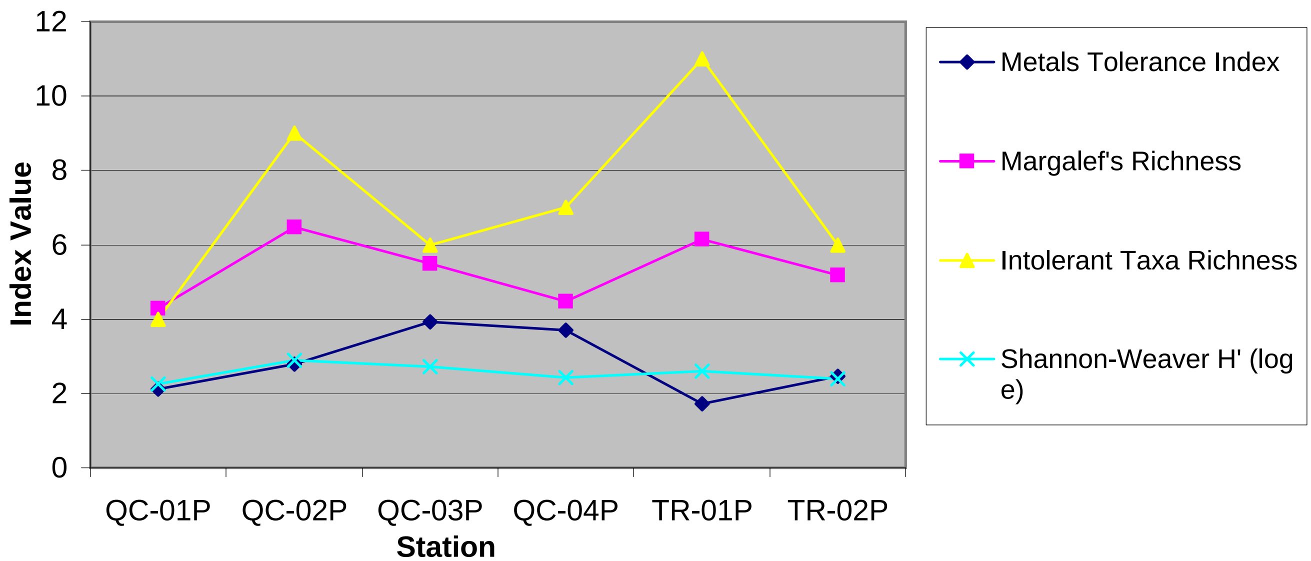


Figure D-5
Community Compostion In Riffle Habitats
Rainy Mine; North Bend, Washington

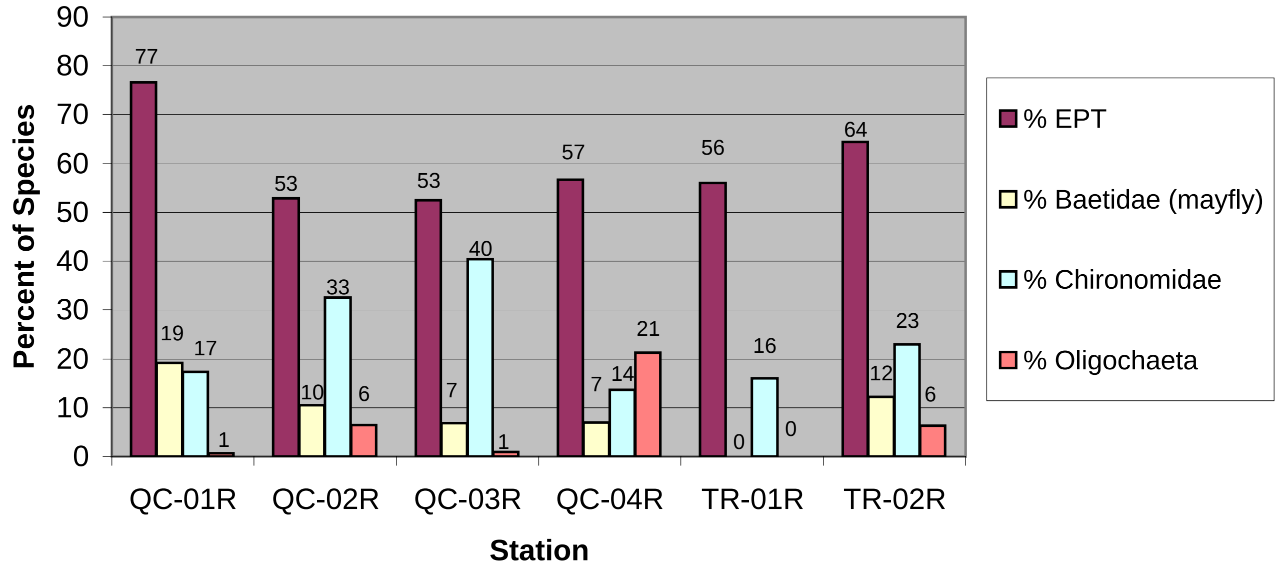
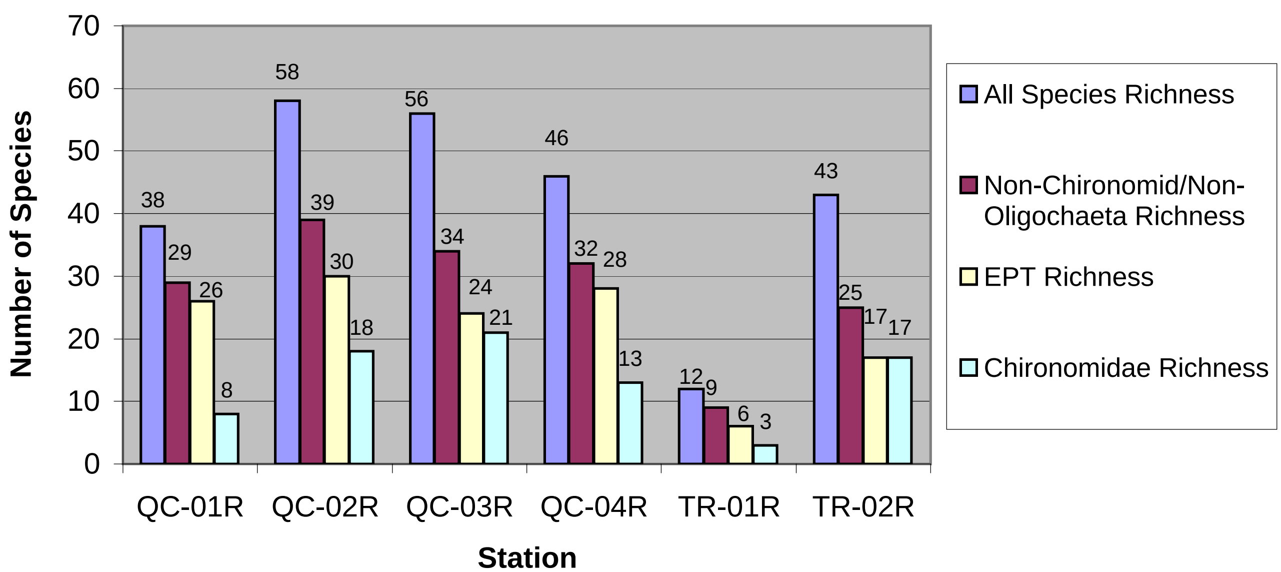


Figure D-6
Species Diversity In Riffle Habitats
Rainy Mine; North Bend, Washington



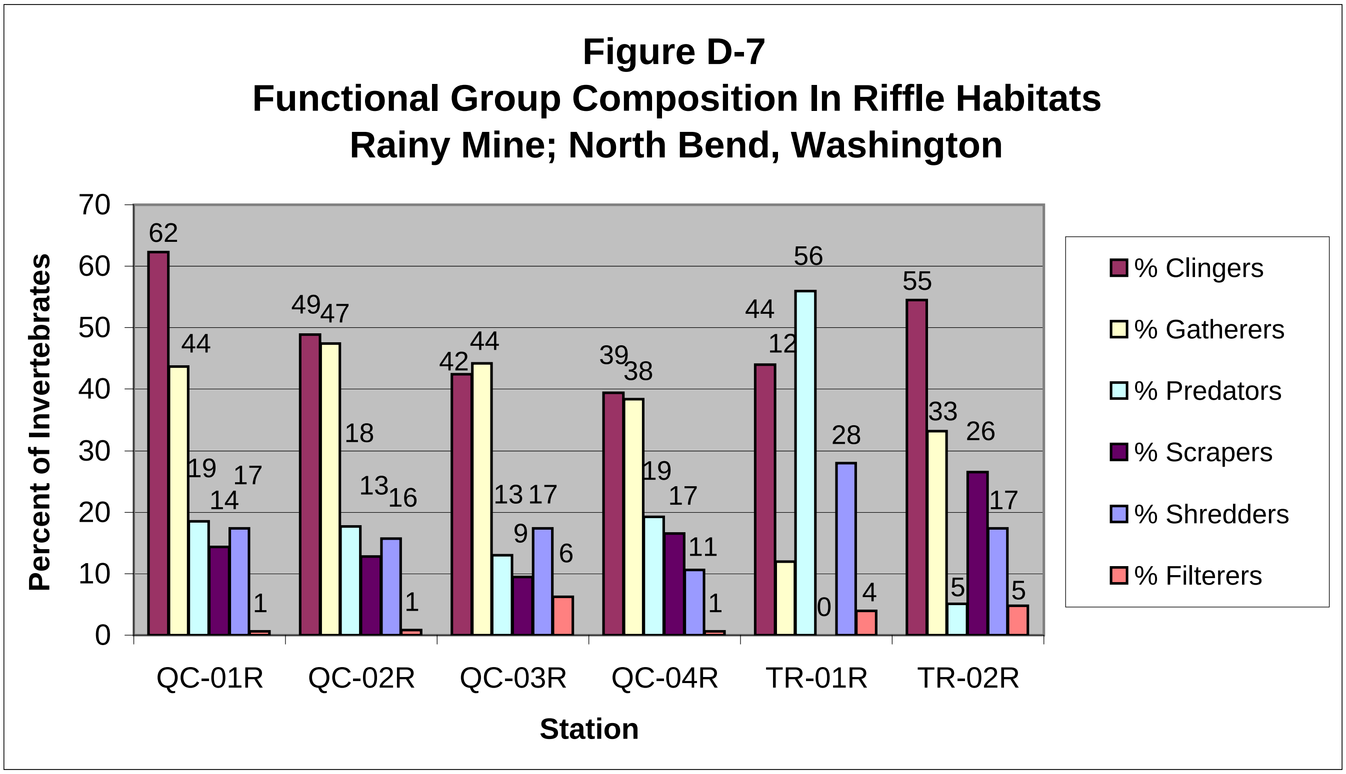


Figure D-7
Functional Group Composition In Riffle Habitats
Rainy Mine; North Bend, Washington
Percent of Invertebrates
Station
QC-01R
QC-02R
QC-03R
QC-04R
TR-01R
TR-02R
% Clingers
% Gatherers
% Predators
% Scrapers
% Shredders
% Filterers
62 44 19 14 17 1
49 47 18 13 16 1
42 44 13 9 17 6
39 38 19 17 11 1
44 12 56 0 28 4
55 33 5 26 17 5

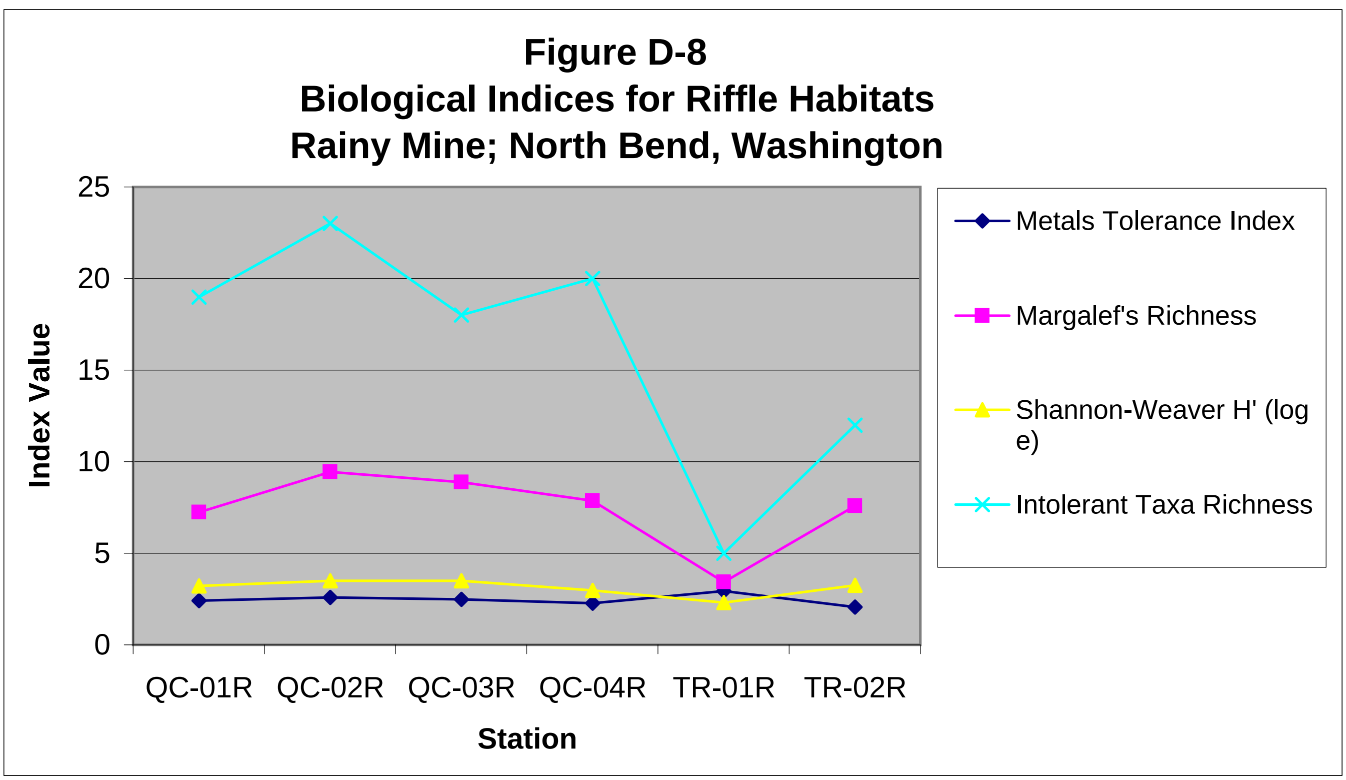


Figure D-8
Biological Indices for Riffle Habitats
Rainy Mine; North Bend, Washington
Index Value
Station
QC-01R
QC-02R
QC-03R
QC-04R
TR-01R
TR-02R
Metals Tolerance Index
Margalef's Richness
Shannon-Weaver H' (log e)
Intolerant Taxa Richness

TABLE D-1
DOCUMENTED AQUATIC INVERTEBRATE SPECIES
RAINY MINE
NORTH BEND, WASHINGTON

Taxonomic Group	Scientific Name	Taxonomic Group	Scientific Name
Ephemeroptera	Ameletus sp.	Diptera-Chironomidae	Parakiefferiella sp.
	Baetis tricaudatus		Parametriocnemus sp.
	Caudatella jacobi		Paraphaenocladius "n. sp."
	Cinygmula sp.		Paraphaenocladius sp.
	Diphetor hageni		Parorthocladius sp.
	Drunella doddsi		Polypedilum sp.
	Drunella spinifera		Rheocricotopus sp.
	Epeorus deceptivus		Rheosmittia sp.
	Epeorus grandis		Rheotanytarsus sp.
	Epeorus longimanus		Smittia sp.
	Epeorus sp.		Stempellina sp.
	Ephemerella inermis/infrequens		Stempellinella sp.
	Ephemerellidae		Synorthocladius sp.
	Heptageniidae		Tanytarsus sp.
	Paraleptophlebia sp.		Thienemanniella sp.
	Rhithrogena sp.		Thienemannimyia gr. sp.
	Serratella sp.		Tvetenia bavarica gr.
	Serratella tibialis		Zavrelimyia sp.
Plecoptera	Calineuria californica	Diptera	Atherix sp.
	Chloroperlidae		Bezzia/Palpomyia sp.
	Doroneuria sp.		Ceratopogonidae
	Kathroperla sp.		Chelifera sp.
	Leuctridae		Clinocera sp.
	Malenka sp.		Cryptolabis sp.
	Perlidae		Dicranota sp.
	Perlodidae		Empididae
	Plecoptera		Hexatoma sp.
	Plumiperla sp.		Limnophila sp.
	Pteronarcys sp.		Oreogeton sp.
	Sweltsa sp.		Prosimulium sp.
	Visoka cataractae		Simulium sp.
	Yoraperla sp.		Tabanidae
	Zapada columbiana		Wiedemannia sp.
	Zapada sp.	Trichoptera	Chyranda centralis
Coleoptera	Heterlimnius sp.		Desmona sp.
	Lara sp.		Dolophilodes sp.
	Narpus sp.		Ecclisocosmoecus scylla
	Oreodytes sp.		Hydropsychidae
	Zaitzevia sp.		Lepidostoma sp.
Diptera-Chironomidae	Boreoheptagyia sp.		Limnephilidae
	Brillia sp.		Micrasema sp.
	Brundiniella sp.		Neophylax sp.
	Chaetocladius sp.		Neophylax splendens
	Corynoneura sp.		Neothremma sp.
	Cricotopus bicinctus gr.		Parapsyche elsis
	Cricotopus sp.		Parapsyche sp.
	Eukiefferiella brehmi gr.		Philopotamidae
	Eukiefferiella brevicalcar gr.		Polycentropus sp.
	Eukiefferiella gracei gr.		Psychoglypha sp.
	Eukiefferiella tirolensis		Rhyacophila angelita gr.
	Heleniella sp.		Rhyacophila betteni gr.
	Heterotrissocladius marcidus gr.		Rhyacophila narvae
	Krenosmittia sp.		Rhyacophila sp.
	Larsia sp.		Trichoptera
	Micropsectra sp.	Bivalvia	Pisidium sp.
	Microtendipes rydalensis gr.		Sphaeriidae
	Odontomesa sp.	Annelida	Oligochaeta
	Orthocladiinae	Acari	Acari
	Orthocladius (Euorthocladius) sp.	Crustacea	Ostracoda
	Orthocladius Complex	Other Organisms	Nematoda
	Orthocladius sp.		Polycelis sp.
	Parachaetocladius sp.		

TABLE D-2
SUMMARY OF RARE, THREATENED, OR ENDANGERED SPECIES IN THE VICINITY
RAINY MINE
NORTH BEND, WASHINGTON

Common Name	Species Name	State Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
AQUATIC INVERTEBRATES					
None					
FISH					
Coastal cutthroat	***Oncorhynchus clarki clarki***		**Concern**		**Observed**
Rainbow Trout	*Oncorhynchus Mykiss*	Priority			Possible
PLANTS					
None					
TERRESTRIAL INVERTEBRATES					
None					
REPTILES AND AMPHIBIANS (HERPETILES)					
Rocky Mountaiin Tailed Frog	*Ascaphus montanus*	Candidate			Expected
Western toad	*Bufo boreas*	Candidate	Concern		Possible
Oregon spotted frog	*Rana pretiosa*	Endangered	Candidate	Sensitive	Possible
BIRDS					
Olive-sided flycatcher	*Contopus borealis*		Concern		Expected
Pileated woodpecker	*Dryocopus pileatus*	Candidate			Expected
Black-backed woodpecker	*Picoides arcticus*	Candidate			Possible
Golden eagle	*Aquila chrysaetos*	Candidate			Possible
Harlequin duck	*Histrionicus histrionicus*	Priority			Possible
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	Threatened		Possible
Northern goshawk	*Accipiter gentilis*	Candidate	Concern	Sensitive	Expected
Spotted owl	*Strix occidentalis*	Endangered	Threatened		Possible
Willow flycatcher	*Empidonax traillii*		Concern		Expected
MAMMALS					
Columbia black-tailed deer	*Odocoileus hemionus columbianus*	Priority			Expected
Fisher	*Martes pennanti*	Endangered	Concern	Sensitive	Expected
Keen's myotis	*Myotis keenii*	Candidate			Possible
Lynx	*Lynx canadensis*	Threatened	Threatened	Sensitive	Possible
Pacific Townsend's big-eared bat	*Coryhorhinus townsendii townsendii*	Candidate	Concern		Possible
Roosevelt elk	*Cervus elaphus roosevelti*	Priority			Possible
Yuma myotis	*Myotis yumanensis*	none	Concern		Possible

Notes:

Blank status indicates the species is not rare, threatened, or endangered under that jurisdiction.

Bold indicates species identified at or near the Rainy mine.

TABLE D-3
OBSERVED PLANT SPECIES
RAINY MINE
NORTH BEND, WASHINGTON

Common Name	Scientific Name	Habitat Type	Percent Cover	Federal Status	State Status	U.S. Forest Service Status
TREES						
Western hemlock	*Tsuga heterophylla*	Disturbed Mine	60			
Western red cedar	*Thuja plicata*	Disturbed Mine	20			
Red alder	*Alnus rubra*	Disturbed Mine	5			
Western hemlock	*Tsuga heterophylla*	Forest	70			
Pacific silver fir	*Abies amabilis*	Forest	20			
Western hemlock	*Tsuga heterophylla*	Riparian	20			
Red alder	*Alnus rubra*	Riparian	15			
Western red cedar	*Thuja plicata*	Riparian	8			
SHRUBS						
Snowberry	*Symphoricarpos albus*	Disturbed Mine	8			
Indian plum	*Oemlaria cerasiformis*	Disturbed Mine	5			
Red elderberry	*Sambucus racemosa*	Disturbed Mine	3			
salmonberry	*Rubus spectabilis*	Disturbed Mine	3			
Sitka willow	*Salix sitchensis*	Disturbed Mine	3			
Snowberry	*Symphoricarpos albus*	Forest	20			
Devil's club	*Oplopanax horridus*	Forest	5			
salmonberry	*Rubus spectabilis*	Forest	5			
Vine maple	*Acer circinatum*	Forest	5			
Vine maple	*Acer circinatum*	Riparian	70			
salmonberry	*Rubus spectabilis*	Riparian	20			
Snowberry	*Symphoricarpos albus*	Riparian	5			
Devil's club	*Oplopanax horridus*	Riparian	3			
Goats beard	*Aruncus dioicus*	Riparian	3			
Oval-leaved blueberry	*Vaccinium ovalfolium*	Riparian	3			
Thimbleberry	*Rubus parviflorus*	Riparian	3			
GROUNDCOVER						
Deer fern	*Blechnam spicant*	Disturbed Mine	8			
Bleeding heart	*Dicentra formosa*	Disturbed Mine	3			
Bracken fern	*Pteridium aquilinum*	Disturbed Mine	3			
Sitka sedge	*Carex sitchensis*	Disturbed Mine	3			
Smooth sedge	*Carex laevicularis*	Disturbed Mine	3			
Wild ginger	*Asarum caudatum*	Disturbed Mine	3			
Bleeding heart	*Dicentra formosa*	Riparian	3			
Broad-leaved bluebell	*Mertensia platyphylla*	Riparian	3			
Cleavers	*Galium aparine*	Riparian	3			
Coast boykinia	*Boykinia elata*	Riparian	3			
Cooley's hedgenettle	*Stachys coolyei*	Riparian	3			
Deer fern	*Blechnam spicant*	Riparian	3			
Mountain arnica	*Arnica latifolia*	Riparian	3			
Oak fern	*Gymnocarpium dryopteris*	Riparian	3			
Red columbine	*Aquilegia formosa*	Riparian	3			
Rusty saxifrage	*Saxifraga ferruginea*	Riparian	3			
Small-flowered woodrush	*Lazula parviflora*	Riparian	3			
Tall larkspur	*Delphinium glaucum*	Riparian	3			
Vanilla leaf	*Achlys triphylla*	Riparian	3			
Wild ginger	*Asarum caudatum*	Riparian	3			
MOSSES						
Tree moss	*Climacium dendroides*	Forest	35			
LICHENS						
None Identified						

Notes:

Blank status indicates the species is not rare, threatened, or endangered.

TABLE D-4
DOCUMENTED OR EXPECTED TERRESTRIAL INVERTEBRATES
RAINY MINE
NORTH BEND, WASHINGTON

Common Name	Scientific Name	Federal Status	State Status	U.S. Forest Service Status	Observed/ Expected/ Possible
Banana slug	*Ariolimax columbianus*				Observed
Black carpenter ants	*Camponotus pennsylvanicus*				Observed
Common black ground beetle	*Pterostichus* sp.				Observed
Black flies	*Simulium* sp.				Observed
Spiders	Order *Araneae*				Observed
Black-foot tightcoil snail	*Pristiloma chirstenella*				Observed

Notes:

Bold indicates regulated or managed species observed, expected, or possible at the site.

Blank status indicates no listing was available for the species.

TABLE D-5
DOCUMENTED OR EXPECTED BIRDS
RAINY MINE
NORTH BEND, WASHINGTON

Scientific Name	Oregon State Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
Cinclus mexicanus				Observed
Turdus migratorius				Observed
Parus atricapillus				Observed
Oporornis tolmiei				Observed
Empidonax difficilis				Observed
Selasphorus rufus				Observed
Pipilo erythrophthalmus				Observed
Cyanocitta stelleri				Observed
Catharus ustulata (Hylocichla ustulata)				Observed
Ixoreus naevius				Observed
Troglodytes troglodytes				Observed
Corvus brachyrhynchos				Expected
Dendroica auduboni				Expected
Columba fasciata				Expected
Strix varia				Expected
Certhia familiaris				Expected
Bombycilla cedrorum				Expected
Junco hyemalis				Expected
Picoides pubescens (Dendrocopos pubescens)				Expected
Hesperiphona vespertina				Expected
Bubo virginianus				Expected
Picoides villosus (Dendrocopos villosus)				Expected
Empidonax hammondii				Expected
Colaptes auratus (Colaptes cafer)				Expected
Corvus caurinus				Expected
Contopus sordidulus				Expected
Dryocopus pileatus	**Candidate**			**Expected**
Pinicola enucleator				Expected
Carduelis pinus (Spinus pinus)				Expected
Loxia curvirostra				Expected
Sitta canadensis				Expected
Regulus calendula				Expected
Bonasa umbellus				Expected
Aegolius acadicus				Expected
Accipiter striatus				Expected
Piranga ludoviciana				Expected
Sphyrapicus varius				Expected
Haliaeetus leucocephalus		**Threatened**		**Possible**
Megaceryle alcyon				Possible
Pheucticus melanocephalus				Possible
Dendragapus obscurus				Possible
Cyanocitta cristata				Possible
Stellula calliope				Possible
Chordeiles minor				Possible
Accipiter cooperii				Possible
Empidonax oberholseri				Possible
Otus Flammeolus	**Candidate**			**Possible**
Passerella iliaca				Possible
Strix nebulosa				Possible
Catharus guttatus (Hylochichla guttata)				Possible
Sialia currucoides				Possible
Accipiter gentilis	**Candidate**			**Possible**
Vermivora celata				Possible
Falco peregrinus	**Sensitive**	**Concern**	**Sensitive**	**Possible**
Carpodacus purpureus				Possible
Sphyrapicus ruber				Possible
Buteo jamaicensis				Possible
Strix occidentalis	**Endangered**	**Threatened**		**Possible**
Picoides tridactylus				Possible
Myadestes townsendi				Possible
Dendroica townsendi				Possible
Cathartes aura				Possible
Sialia mexicana				Possible
Empidonax difficilis				Possible
Contopus sordidulus				Possible
Loxia leucoptera				Possible
Sphyrapicus thyroideus				Possible
Dendroica coronata				Possible

Notes:

Bold indicates regulated or managed species observed, expected, or possible at the site.

Blank status indicates no listing was available for the species.

TABLE D-6
DOCUMENTED OR EXPECTED MAMMALS
RAINY MINE
NORTH BEND, WASHINGTON

Scientific Name	State Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
Ursus americanus				Observed
Odocoileus hemionus columbianus				Observed
Tamiasciurus douglasi				Observed
Aplodontia rufa				Expected
Odocoileus hemionus columbianus	**Priority**			**Expected**
Canis latrans				Expected
Peromyscus maniculatus				Expected
Sorex obscurus				Expected
Martes pennanti	**Endangered**	**Concern**	**Sensitive**	**Expected**
Mustela frenata				Expected
Martes americana	**Critical**		**Sensitive**	**Expected**
Mustela vision				Expected
Felis concolor				Expected
Erethizon dorsatum				Expected
Procyon lotor				Expected
Lepus americanus				Expected
Coryhorhinus townsendii	**Critical**	**Concern**	**Sensitive**	**Expected**
Eptisicus fuscus			**Sensitive**	**Possible**
Clethrionomys gapperi				Possible
Myotis californicus				Possible
Martes pennanti	**Critical**	**Concern**	**Sensitive**	**Possible**
Myotis thysanodes	**Vulnerable**	**Concern**	**Sensitive**	**Possible**
Felis concolor				Possible
Myotis keenii	**Candidate**			**Possible**
Myotis lucifugus			**Sensitive**	**Possible**
Lynx canadensis	**Threatened**	**Threatened**	**Sensitive**	**Possible**
Sorex cinereus				Possible
Sylvilagus nuttalli				Possible
Glaucomys sabrinus				Possible
Sorex palustris				Possible
Didelphis marsupialis				Possible
Coryhorhinus townsendii townsendii	**Candidate**	**Concern**		**Possible**
Antozous pallidus	**Vulnerable**			**Possible**
Sorex preblei	**Concern**		**Sensitive**	**Possible**
Vulpes fulva				Possible
Tamiasciurus hudsonicus				Possible
Cervus elaphus roosevelti	**Priority**			**Possible**
Mustela erminea				Possible
Lasionycteris noctivagans			**Sensitive**	**Possible**
Myotis leibii		**Concern**		**Possible**
Sorex trowbridgei				Possible
Sorex vagrans				Possible
Odocoileus verginianus				Possible
Gulo gulo luteus		**Concern**	**Sensitive**	**Possible**
Myotis yumanensis		**Concern**		**Possible**

expected, or possible at the site.

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TABLE D-7
DOCUMENTED OR EXPECTED AMPHIBIANS, REPTILES, AND INVERTEBRATES
RAINY MINE
NORTH BEND, WASHINGTON

Common Name	Scientific Name	Federal Status	State Status	U.S. Forest Service Status	Observed/ Expected/ Possible
AMPHIBIANS					
Cascades frog	***Rana cascadae***			**Sensitive**	**Observed**
Red-legged frog	***Rana aurora***			**Sensitive**	**Observed**
Tailed frog	***Ascaphus montanus***	**Concern**			**Observed**
Larch Mountain salamander	*Plethodon larselii*				Expected
Long-toed salamander	*Ambystoma macrodactylum*				Expected
Northwestern salamander	*Ambystoma gracile*				Expected
Pacific giant salamander	*Dicamptodon tenebrosus*				Expected
Pacific treefrog	*Hyla regilla*				Expected
Rough-skinned newt	*Taricha granulosa*				Expected
Western red-backed salamander	*Plethodon vehicullum*				Expected
Western toad	***Bufo boreas***	**Concern**	**Candidate**		**Expected**
Ensatina	*Ensatina eschscholtzii*				Possible
Spotted frog	***Rana pretiosa***	**Candidate**	**Endangered**	**Sensitive**	**Possible**
REPTILES					
Common garter snake	*Thamnophis sirtalis*				Expected
Northern alligator lizard	*Gerrhonotus coeruleus*				Expected
Northwestern garter snake	*Thamnophis ordinoides*				Possible
Rubber boa	*Charina bottae*				Possible

Notes:

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Blank status indicates no listing was available for the species.