Appendix C.

Streamlined Human and Ecological Risk Assessments

Human Health and Ecological Risk Assessment
Monte Cristo Mining Area
Mt. Baker-Snoqualmie National Forest

April 2010

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Human Health and Ecological Risk Assessment
Monte Cristo Mining Area
Mt. Baker-Snoqualmie National Forest

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Cover Photograph: Entrance to the Monte-Cristo Mining Area.

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ACRONYMS

ADD	average daily dose
CEEM	conceptual ecological exposure model
CHEM	conceptual human health exposure model
COI	chemical of interest
COPC	chemical of potential concern for human health
COPEC	chemical of potential ecological concern
CTE	central tendency exposure
Ecology	Washington State Department of Ecology
ECR	Excess Cancer Risk
EECA	Engineering Evaluation / Cost Analysis
EPC	exposure point concentrations
ERA	ecological risk assessment
ERBSC	ecological risk-based screening concentration
HHRA	human health risk assessment
LOAEL	lowest-observed adverse effect level
NOAEL	no-observed-adverse-effect-level
ODEQ	Oregon Department of Environmental Quality
PRG	preliminary remediation goals
SI	Site Inspection
RBC	risk based concentration
RfD	reference doses
RME	reasonable maximum exposure
RTE	rare, threatened, or endangered
TEE	Terrestrial Ecological Evaluation
95UCL	95th percentile upper confidence limit on the arithmetic mean
USEPA	United States Environmental Protection Agency
Forest Service	United States Department of Agriculture, Forest Service
WOE	Weight of Evidence

1.0 INTRODUCTION

Potential human health and ecological risks associated with mining-related contamination at the Monte Cristo Mining Area (Site) were assessed through a streamlined risk assessment process consistent with U.S. Environmental Protection Agency (USEPA) and Washington State Department of Ecology (Ecology) guidelines. Potential risks and hazards were evaluated by comparing site-specific chemical concentrations to readily available risk-based screening concentrations for selected human health and ecological exposure pathways. Section 2.0 describes the analytical data used and the initial screening which determines the chemicals of interest (COIs). The human health risk assessment (HHRA) and ecological risk assessment (ERA) are presented in Sections 3.0 and 4.0, respectively. Conclusions and recommendations based on the results of the risk assessments are presented in Section 5.0.

2.0 RISK ASSESSMENT DATA AND INITIAL SCREENING

This section describes the analytical data used in the risk assessment and the initial data screening process. The analytical data are for media samples collected from the Site during the Site Inspection (CES, 2007) and the Engineering Evaluation/Cost Analysis (EECA; CES, 2009). In accordance with SI and EECA methodology, media samples were generally collected in areas where contamination was known or suspected to occur to identify worst case concentrations at the Site. This approach is conservative in that it results in an over-estimation of site-related chemical concentrations rather than an underestimation, and is appropriate for screening level risk assessments.

The analytical data incorporated into the risk assessment were based on the following samples collected during the SI (CES, 2007).

- 10 background surface soil samples
- 12 background surface water samples
- 3 background pore water samples
- 7 background sediment samples
- 96 surface soil/waste rock samples
- 56 surface water samples
- 17 pore water samples
- 37 sediment samples

These samples were analyzed primarily for metals. Standard laboratory quality control procedures were used and analytical results were quality assured and qualified, as necessary, by the laboratory. These analytical data were considered good quality and useable (as qualified) for the risk assessment.

The site-related data collected during the SI were initially screened using the following criteria:

- Essential Nutrients: Calcium, magnesium, potassium, and sodium were removed from further assessment because they are considered to be non-toxic essential nutrients (USEPA, 1989).
- Frequency of Detection: COIs that were detected in 5% or fewer of the samples were removed from further consideration.
- Background: Data points with metals concentrations (1) less than the 95th percentile upper confidence limit (95UCL) on the arithmetic mean of background samples for each medium, (2) less than the mean background concentration if too few samples were available to calculate the 95UCL, or (3) less than the mean background concentration if the 95UCL was greater than the maximum background concentration, were eliminated from further assessment.
- Reporting Limits: COIs with maximum reporting limit concentrations greater than background concentrations and the lowest medium-specific human health or ecological screening risk-based screening concentration were retained for further assessment.

For the reporting limit screening, the risk-based screening concentrations for human health were the USEPA soil and tap water Risk Based Concentrations (RBCs) for soil and water exposure, respectively. The ecological risk-based screening concentrations (ERBSCs) are shown in Appendix A1 and discussed in Section 4.2.

Where the dataset contains five or more samples and were normally distributed, the 95UCL was calculated in accordance with Ecology (2007) guidelines. For log-normally distributed data the 95UCL was calculated using Land's Method (Gilbert, 1987). For data sets wherein neither a normal nor a lognormal distribution could be demonstrated, a Z calculation adjusted for skewness was used to determine the 95UCL calculation (USEPA, 1997a**).** In addition, UCLs were calculated using USEPA's ProUCL software (USEPA, 2004a) and the lower of the 95UCL or the maximum was used as the EPC. The lowest of the distribution appropriate UCLs, or maximum detected concentrations (if the maximum concentration was less than the UCLs), was used as the EPC. For data sets with less than five samples, the maximum detected concentration was used as the EPC.

Table 2-1 lists the chemicals retained following the initial screening. The detailed HHRA initial screening tables are provided in Appendix A for samples either "Near" the Monte Cristo Townsite with relatively easy human access, or "Remote" from the Monte Cristo Townsite with limited or difficult access.

Table 2-1. Chemicals of Interest Remaining Following the Initial Screening

COIs	Surface Soil/ Waste Material		Surface Water		Drinking Water	Pore Water		Sediment	
	HHRA	ERA	HHRA	ERA	HHRA	HHRA	ERA	HHRA	ERA
Aluminum		X	X	X			X	X	X
Antimony	X	X	X	X	X		X	X	X
Arsenic, III		X		X			X		X
Arsenic, V		X		X			X		X
Arsenic, total	X	X	X	X	X		X	X	X
Barium	X	X	X	X	X			X	X
Beryllium	X	X						X	X
Cadmium	X	X	X	X	X		X	X	X
Chromium VI							X		
Chromium, total	X	X						X	X
Cobalt	X	X	X	X				X	X
Copper	X	X	X	X	X		X	X	X
Iron	X	X	X	X	X			X	X
Lead	X	X	X	X	X		X	X	X
Manganese	X	X	X	X	X			X	X
Mercury	X	X	X	X	X		X	X	X
Methyl Mercury		X						X	X
Nickel	X	X						X	X
Selenium	X	X	X	X	X				
Silver	X	X	X	X	X		X	X	X
Thallium	X	X	X	X				X	X
Vanadium	X	X						X	X
Zinc	X	X	X	X	X		X	X	X

NOTES:
X = Indentified COI

3.0 HUMAN HEALTH RISK ASSESSMENT

The HHRA evaluated the potential for adverse health effects that could result from current or future human exposures to contaminants present at the Site. The purpose of this evaluation was to select chemicals of potential concern (COPCs) from the COIs using approved human health risk-based screening procedures, and to calculate the exposure doses for each COPC and receptor. The exposure doses were then compared to acceptable doses of the COPCs using approved screening numbers. The following are the primary elements of the HHRA.

- Hazard Identification and Selection of COPCs
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization
- Summary of Human Health Risks

3.1 Hazard Identification and Selection of COPCS

This section presents the rationale for the selection of the COPCs. The media of interest for human health included surface soil, surface water, and sediment. Maximum concentrations of the COIs in these media were compared to the USEPA Risk Based Concentration Table. Considering that potential receptors are seasonal cabin owners or visitors that do not reside on or adjacent to contaminated soils, industrial screening values were selected as the most appropriate screening criteria for soil and sediment. Similarly, tap water RBCs represented a very conservative screen for surface water. Table 3-1 lists the COPCs. Appendix B1 presents the preliminary remediation goal (PRG) screening and results.

Table 3-1. Contaminants of Potential Concern for the Human Health Exposure Media

COPCs	Surface Soil	Surface Water	Sediment
Antimony	X		
Arsenic	X	X	X
Lead	X	X[1]	

NOTES:
X = COPC for the Site
[1] There is no PRG for lead in surface water; it was, therefore, selected as a COPC.

3.2 Exposure Assessment

Assessing the exposure at the Site includes: 1) the development of a conceptual human health exposure model (CHEM), which includes identification of potentially exposed populations and the development of exposure pathways; and 2) the calculation of exposure point concentrations (EPCs) and average daily doses (ADD).

3.2.1 Conceptual Human Exposure Model

The CHEM is a flow chart that outlines contaminant sources, release mechanisms, transport routes and media, potential receptor populations, and potential exposure routes. The CHEM identifies the potential receptors and exposure pathways at the Site. The CHEM for the Site is presented in Figure 3-1. Justification and further discussion on the exposure routes and receptors are provided in the following sections.

Potentially Exposed Population

The Site consists of ten mining sites and facilities associated with ore hauling, storing, and processing. The Site is spread along several miles of Glacier Creek and Seventysix Gulch. Land uses in the area are limited to

timber harvesting, firewood cutting, recreation (hiking, fishing, camping, hunting, etc.), and some mineral prospecting. There are no onsite workers. Site use is primarily recreational in nature and varies from day visitors to overnight campers to seasonal residents in the vicinity. For purposes of this risk assessment, mining sites were divided into "Near" and "Remote" features/locations as shown in Table 3-2.

Table 3-2. Delineation of Monte Cristo Mining-Related Features

Near Features	Remote Features
Haulage Ways	Pride of the Mountains Mine
Concentrator	New Discovery Mine
Collector	Pride of the Woods Mine
Assay Shack	Mystery Mine
Boston-American Mine	Golden Cord Mine
Rainy Mine	Justice Mine
	Sheridan Mine
	Sidney Mine

Near locations were defined as those close to the Monte Cristo Townsite and having fairly easy human access. The potentially exposed population for the Near locations was determined to be seasonal residents, consisting of children and adults. Remote locations are typified by difficult terrain, lack of amenities, infrequent use, and difficult access. The potentially exposed population for the Remote locations was determined to be occasional visitors. Due to limited accessibility and difficulty of terrain, only adult exposures were considered for these locations. Public access records are not maintained**.** Access is currently not restricted by fencing, nor were any "No Trespassing" signs observed. The potential for significant activity is considered to be moderate to high at the Near locations and low at the Remote locations.

Identification of Potential Exposure Pathways

This section evaluates potential pathways for human exposures to the identified COIs. Complete exposure pathways were evaluated for receptors within the current and future potentially exposed populations and included:

- Inhalation of soil and dust particulates;
- Incidental ingestion of soil and sediment;
- Ingestion of surface water as a drinking water source;
- Dermal contact with soil, surface water and sediment;
- Ingestion of fish

Although lead was identified as a COI in surface water, it cannot be quantitatively addressed because no toxicity value is available. Lead will be addressed qualitatively in the risk characterization section of the report. Use of groundwater as potential drinking water was eliminated as a pathway of concern because there are no reported drinking water wells within several miles of the Site. Information regarding the hydrogeology surrounding the Site and groundwater pathway was presented in the SI and was updated in the EECA.

3.2.2 Exposure Assumptions

Exposure assumptions include factors such as body weight, averaging time, exposure frequency, exposure duration, and chemical bioavailability. For each of the seasonal resident and occasional visitor populations, separate assumptions were made to determine central tendency or average exposure (CTE) and the reasonable maximum exposure (RME). In general, the RME scenario is a conservative or worst-case

estimate of potential exposure, while the CTE scenario typically uses exposure factors that are more indicative of the average user.

Neither the USEPA nor Ecology has developed default scenarios for recreational or camping exposure scenarios at abandoned mines. However, exposure assumptions used for this HHRA have been developed based on considerations of Site location and access. The seasonal resident at the Near location was assumed to spend considerably more time at the Site. Because of easier access to the Site and nearby amenities, both child and adult exposures were considered. Typical USEPA default exposure for a child is six (6) years. Therefore, the CTE exposure assumed six (6) years as a child and nine (9) years as an adult; the RME exposure scenario assumed six (6) years as a child and twenty four (24) years as an adult. Because of the limited access and the difficult terrain, occasional visitors at the Remote locations were assumed to be adults and no childhood exposures were considered. The exposure factors used in this risk assessment are presented in Appendix B2.

3.2.3 Exposure Point Concentrations and Average Daily Dose

An EPC represents the COPC concentration in each exposure medium that a receptor will potentially contact during the exposure period. Generally, the EPC is not the maximum concentration detected at the Site because, in most situations, it is not reasonable to assume long-term contact with the maximum concentration. Therefore, for each set of exposure assumptions, the 95UCL was used as the EPC for determining RME and the mean chemical concentration was used for determining CTE. The human health EPCs are presented in Tables 3-2 and 3-3 along with the basis for the EPC.

In combination with the exposure factors and chemical-specific parameters (Appendices B3 through B5), the EPCs are used to calculate the ADD of a for each receptor type identified in the CHEM. The ADDs are used to determine the potential for adverse human health effects and are shown in Appendix B5. Potential human health effects and toxicity values of the COPCs are discussed in the next section.

Table 3-2. Exposure Point Concentrations: Near Locations

COPC	Number of Samples	Maximum	CTE[1] EPC	RME[2] EPC	Comments
Surface Soil (mg/kg)					
Antimony	46	9.86E+-03	1.8E+03	2.9E+03	Gamma
Arsenic	46	9.21E+04	2.0E+04	2.7E+04	Gamma
Sediment (mg/kg)					
Arsenic	34	1.1E+03	3.3E+02	6.7E+02	Chebyshev
Surface Water (µg/L)					
Arsenic	31	6.85E+1	1.1E+01	1.7+01	95UCL

NOTES:
1 Simple average concentration.
2 Lower of 95UCL or maximum if greater than five data points; maximum concentration if less than five data points.
Abbreviations: mg/kg = milligrams per kilogram, Zadj = 95UCL calculated using the Central Limit Theorem adjusted for skewness, µg/L = micrograms per liter.

Table 3-3. Exposure Point Concentrations- Remote Locations

COPC	Number of Samples	Maximum	CTE[1] EPC	RME[2] EPC	Comments
Surface Soil (mg/kg)					
Antimony	31	8.8E+-03	7.2E+02	3.9E+03	95UCL lognormal
Arsenic	34	7.3E+04	1.4E+04	2.0E+04	gamma
Sediment (mg/kg)					
Arsenic	6	3.7E+02	1.9E+02	2.9E+02	95% Jackknife
Surface Water (µg/L)					
Arsenic	6	4.1E+03	6.8E+02	2.6E+03	95UCL

NOTES:
1 Simple average concentration.
2 Lower of 95UCL or maximum if greater than five data points; maximum concentration if less than five data points.
Abbreviations: mg/kg = milligrams per kilogram, Zadj = 95UCL calculated using the Central Limit Theorem adjusted for skewness, µg/L = micrograms per liter.

3.3 Toxicity Assessment

The purpose of the toxicity assessment is to present the critical toxicity factors for the COPCs (Appendix B). The purpose of the toxicity assessment is twofold:

- To identify the carcinogenic and noncarcinogenic effects that may arise from direct or indirect exposure of humans to the COPCs ; and
- To provide an estimate of the quantitative relationship between the magnitude and duration of exposure, and the probability or severity of adverse effects.

3.3.1 Toxicity Values

Toxicity values are used to quantitatively describe the relationship between the extent of exposure to a COPC and the potential increased likelihood of adverse effects. The sources for obtaining toxicity values are listed below.

- Integrated Risk Information System (IRIS) computer database (USEPA, 2006a)
- Health Effects Assessment Summary Table (USEPA, 1997b)

Chemicals are classified into those that cause cancer and those that cause other, noncarcinogenic, health effects. The method for assessing the potential for these two different types of health effects differ. Where a chemical can cause both carcinogenic and noncarcinogenic health affects the risk evaluation calculates the potential for both types of effects. The following sections provide background information on the toxicity values for noncarcinogenic and carcinogenic chemicals.

3.3.2 Noncarcinogenic Toxicity Values

The potential for toxicity of noncarcinogenic COPCs is determined using reference doses (RfDs). An RfD represents an estimated intake rate that is unlikely to produce measurable adverse effects over a lifetime of exposure. The RfDs are determined by the USEPA RfD Work Group or from the health effects assessment documents developed by the USEPA Office of Research and Development.

An RfD assumes a threshold for adverse noncarcinogenic effects. That is, exposures below the RfD are considered unlikely to cause any adverse health effects. RfDs are route-specific; that is, RfDs may be different for ingestion, inhalation, or other routes of exposure. The critical toxicity values for the noncarcinogenic COPCs are presented in Table 3-4.

Table 3-4. Critical Toxicity Values for Noncarcinogenic COPCs

COPC	CAS Number	Chronic RfD (mg/kg-day)		Confidence in RfD	Endpoint
		Oral	Inhalation		
Antimony	7440-36-0	4.0E-04		low	longevity
Arsenic	7440-38-2	3.0E-04	3.0E-05	medium	hyperpigmentation, vascular

NOTE:
CAS = chemical abstracts service (registration).

3.3.3 Carcinogenic Toxicity Values

Chemicals that cause cancer are classified according to the type of scientific information available about the types of cancer they might produce. This classification system is called the Weight of Evidence (WOE). The 1986 guidelines established five WOE categories, ranging from known human carcinogens (Group A) to chemicals which have been determined not to cause cancer (Group E). Of the COPCs identified at the Site, arsenic is the only carcinogen and is a known human carcinogen.

Unlike noncarcinogens, carcinogenic chemicals are assumed to not to have a threshold value below which no human health effects are likely to be seen. The potential for developing cancer from exposure to a carcinogenic chemical (toxicity value) is determined using a slope factor. The slope factor represents a conservative estimate of the potential carcinogenic risk associated with exposure. It is used with the ADD to calculate the increased probability of developing cancer over a lifetime. This is measured in terms of excess cancer risk (ECR). Slope factors are determined by the USEPA Carcinogen Risk Assessment Verification Endeavor Workgroup, or from the health effects assessment documents developed by the USEPA Office of Research and Development. Based on USEPA guidelines documents, information on the slope factors derived for arsenic is presented in Table 3-5.

Table 3-5. Critical Toxicity Values for Carcinogenic COPCs

COPC	Slope Factor		Weight of Evidence Classification Ingestion/Inhalation	Type of Cancer Ingestion/Inhalation	Basis of Slope Factor Oral/inhalation
	Oral	Inhalation			
	mg/kg/day-1				
Arsenic	1.5E+00	1.5E+01	A	skin	EPI studies

3.3.4 Lead Critical Toxicity Values

Meaningful oral and inhalation critical toxicity values have not been developed for lead. Many of the noncarcinogenic effects associated with lead may not exhibit a threshold, especially in young children. USEPA considers lead to be a B2 carcinogen. In lieu of a reference dose or slope factor, USEPA has developed the Integrated Exposure Uptake/Biokinetic Model and the Adult Lead Model which correlate dose with blood lead levels.

The lowest-observed adverse effect level (LOAEL) of lead is considered to be 10 micrograms per deciliter (µg/dL) in children and fetuses and 30 µg/dL in adults. Empirically-derived ratios of 0.16 and 0.04 µg/dL per

µg/day ingested by children and adults respectively, recommended by USEPA (1986) and FDA (1990), are used to predict concentrations in young children and adults. Applying an uncertainty factor of 10 results in provisional tolerable intake levels of 6 µg/day for children six or less, 15 µg/day for children over six, 25 µg/day for pregnant women, and 75 µg/day for men.

3.4 Risk Characterization

Potential human health impacts associated with exposure to COPCs at the Site were evaluated by estimating the potential for both noncarcinogenic and carcinogenic health effects. The following sections discuss the assessment of noncarcinogenic hazards and carcinogenic risks associated with exposure to COPCs at the Site. The SI sampling locations were selected as locations where levels of concentrations were suspected to be the highest. Targeted sampling identifies the worst-case situations, and is intended to be a conservative data set that is sufficient for the specific purposes of risk assessment.

Noncarcinogenic hazard is estimated as the ratio of the ADD of the noncarcinogenic chemical through a specific exposure route to the chronic RfD for that exposure route. The calculation of the ADD is outlined in Appendix B. This ratio is called the Hazard Quotient. Hazard Quotients (HQ) greater than 1.0 indicate the potential for adverse health effects because the intake exceeds the RfD. A HQ is calculated for each chemical that elicits a noncarcinogenic health effect. The sum of all individual chemical-specific HQs is termed the Hazard Index (HI) and is calculated under each exposure pathway. Thus, a HI less than 1.0 is not anticipated to produce unacceptable human health effects.

Carcinogenic risk is estimated as the probability that a chemical will produce a carcinogenic effect. The excess lifetime carcinogenic risk is the incremental increase in the probability of developing cancer compared to a background probability of developing cancer with no exposure to Site contaminants. The potential for cancer is evaluated in terms of ECRs. The USEPA accepts a risk range of one in ten thousand (1E-04) to one in one million (1E-06); however, Ecology considers an ECR greater than one in one million (1E-06) to be unacceptable. For example, an ECR of 1E-06 represents an increase of one additional case of cancer (above background) in one million people exposed to a carcinogen over their lifetime (70 years).

The results of the quantitative risk assessment are presented below for each medium and presented in Appendix B.

3.4.1 Noncarcinogenic Risk

Arsenic was identified as a noncarcinogenic COPC in surface soil, sediment, and surface water. Antimony was identified as a noncarcinogenic COPC only in soil. These risks are summarized in Tables 3-6 and 3-7 for Near and Remote locations, and seasonal resident and occasional visitor exposure conditions, respectively. Exposure factors, exposure assumptions, exposure parameters, toxicity values, and calculated results for the Near and Remote locations are presented in Appendices B10 through B18 and B19 through B27, respectively

Table 3-6. Summary of Noncarcinogenic Risks: Near Locations

Exposure Route	COPC	Hazard Quotient	
		Central Tendency Exposure	Reasonable Maximum Exposure
Soil			
Ingestion	Antimony	6.6E-04	4.3E-02
	Arsenic	5.1E-02	**2.8**E+00
Inhalation of Particulates	Arsenic	1.2E-04	3.2E-03
Dermal Contact	Arsenic	2.1E-13	1.1E-09
Surface Water			
Ingestion	Arsenic	4.4E-04	3.5E-02
Dermal Contact	Arsenic	4.5E-13	8.8E-10
Sediment			
Ingestion	Arsenic	3.4E-03	1.5E-01
Dermal Contact	Arsenic	3.0E-08	1.5E-07
HAZARD INDEX		0.1	**3.0**

NOTE:
Bold = Unacceptable noncarcinogenic risk identified (i.e., HQ/HI >1)

As shown in Table 3-6, ingestion of arsenic in soil/waste rock under RME condition is the primary driver for unacceptable non-carcinogenic risk at the Near features because the HQ was greater than 1.0 (HQ = 3.0). None of the other pathways of exposure exceed the regulatory standard of 1.0. No unacceptable non-carcinogenic human health impacts are expected under the CTE conditions at Near Locations.

The Remote features represent mines which are located distant from Townsite and wherein access is limited and very difficult. No unacceptable non-carcinogenic risks under either CTE or RME exposure conditions are anticipated at the Remote features.

Table 3-7. Summary of Noncarcinogenic Risks – Remote Locations

Route of Exposure	COPC	Hazard Quotient	
		Central Tendency Exposure	Reasonable Maximum Exposure
Soil			
Ingestion	Antimony	4.4E-05	3.6E-03
	Arsenic	6.2E-03	1.3E-01
Inhalation of Particulates	Arsenic	1.4E-05	1.5E-04
Dermal	Arsenic	2.2E-06	7.4E-04
Sediment			
Ingestion	Arsenic	7.2E-05	2.1E-03
Dermal	Arsenic	8.3E-09	3.0E-06
Surface Water			
Ingestion	Arsenic	2.0E-01	**4.6E+00**
Dermal	Arsenic	6.8E-07	1.8E-05
HAZARD INDEX		0.2	**4.8**

NOTE:
Bold = Unacceptable noncarcinogenic risk identified (i.e., HQ/HI >1)

No unacceptable non-carcinogenic risks under the CTE exposure conditions are anticipated at the Remote features. As shown above in Table 3-7, ingestion of arsenic in surface water under RME condition, is the primary driver for unacceptable non-carcinogenic risk at the Remote features because the HQ was greater than 1.0 (HQ = 4.8). None of the other pathways of exposure at the Remote features exceed the regulatory standard of 1.0.

3.4.2 Carcinogenic Risks

Arsenic was identified as the only carcinogenic COPC at the Site. Risks were characterized for samples at Near and Remote locations, with potential ECR summarized in Table 3-8. Ingestion of arsenic contaminated soil is the critical pathway. Unacceptable human health risks are also anticipated by way of ingestion of arsenic contaminated sediment and surface water under the RME exposure conditions. No other pathways of exposure are anticipated to result in unacceptable human health impacts. Total ECRs for both the CTE and RME receptors exceeded Ecology's regulatory standard of 1E-06.

Table 3-8. Summary of Excess Cancer Risks – Near Locations

Exposure Route	Chemical of Potential Concern	Excess Cancer Risk	
		Central Tendency Exposure	Reasonable Maximum Exposure
Soil			
Ingestion	Arsenic	**7.8E-05**	**4.0E-03**
Dermal Contact	Arsenic	9.6E-17	2.6E-13
Inhalation of Particles	Arsenic	6.8E-09	5.0E-07
Sediment			
Ingestion	Arsenic	2.5E-08	**5.4E-06**
Dermal Contact	Arsenic	6.6E-19	1.3E-15
Surface Water			
Ingestion	Arsenic	4.3E-07	**2.3E-05**
Dermal Contact	Arsenic	2.9E-12	3.4E-10
SUM OF EXCESS CANCER RISK		**7.8E-05**	**4.0E-03**

NOTE:
Bold = Unacceptable carcinogenic risk identified (i.e., ECR > 1E-06)

Ingestion of arsenic in soil and surface water used as drinking water are the drivers for unacceptable excess cancer risks under the CTE and RME exposure conditions for the occasional visitor to the Remote locations. Dermal contact with soil and ingestion of sediment also pose an unacceptable excess cancer risk under RME exposure conditions.

Table 3-9. Summary of Carcinogenic Risks – Remote Locations

Exposure Route	Chemical of Potential Concern	Excess Cancer Risk	
		Central Tendency Exposure	Reasonable Maximum Exposure
Soil			
Ingestion	Arsenic	**1.6E-05**	**1.1E-04**
Dermal Contact	Arsenic	9.4E-09	**2.2E-06**
Inhalation of Particles	Arsenic	2.2E-07	**1.4E-06**
Sediment			
Ingestion	Arsenic	4.6E-07	**1.7E-06**
Dermal Contact	Arsenic	2.2E-10	7.1E-08
Surface Water			
Ingestion	Arsenic	**1.2E-05**	**7.1E-04**
Dermal Contact	Arsenic	3.9E-11	2.8E-09
SUM OF EXCESS CANCER RISK		**2.8E-05**	**8.3E-04**

NOTE:
Bold = Unacceptable carcinogenic risk identified (i.e., ECR > 1E-06)

3.4.3 Fish Ingestion

Ingestion of fish from potentially impacted surface water bodies was determined to be a complete pathway of exposure for the Near features, but not for the Remote features. A quantitative assessment of potential impacts from fish ingestion was limited due to the small number of data samples relative to the multiple surface water bodies and large size of the Site. Therefore, this pathway was evaluated by calculating site-specific RBCs for surface water and sediment that would be protective of the fish ingestion pathway. Data from surface water and sediment sampling were then screened against these values to determine locations where a potential for unacceptable risk exists. As the Site is remediated, these RBCs can be used as cleanup numbers for protection of this pathway. Arsenic surface water and sediment RBCs for the Near locations are presented in Table 3-10.

Table 3-10. RBCs for Surface Water and Sediment - Fish Ingestion Pathway (Near Features)

Medium	Units	Risk Based Concentration (Arsenic)	
		Central Tendency Exposure	Reasonable Maximum Exposure
Surface Water	µg/L	0.04	0.0008
Sediment	mg/kg	0.5	0.01

Sediment screening results determined that with the exception of sample MCEE-SS-MCL-06 (0.281 mg/kg), all sediment samples exceeded the RBCs for the fish consumption pathway for both RBCs. All surface water concentrations exceeded both RBCs. This screening represents a worst case scenario as sampling localities were specifically selected to identify areas of high concentration and the dataset for each waterway was very small, often consisting of one worst case sample. A better characterization of the individual waterways focusing on: 1) representative sampling rather than worst case, 2) collection of more samples that would allow for statistical analysis rather than the use of the maximum concentration, 3) evaluation of the model and tissue sampling to determine if the conservative mathematical model and inputs accurately represent site conditions, and 4) site-specific information on fish consumption, could all affect the risk characterization

results for this pathway of exposure and provide a more site-specific estimate of human health impacts from ingestion of fish. Therefore, the RBCs for sediment and surface water only provide a snapshot of the potential worst case scenario for fish consumption and do not necessarily present a risk characterization of the Site.

3.4.4 Lead

The USEPA's lead models simulate soil lead exposures at a single location. Two models have been developed, the Integrated Exposure Uptake/Biokinetic Model and the Adult Lead Model. These models require a minimum of three months of continuous exposure of at least one day per week. Three months is considered to be the minimum exposure to produce a quasi-steady-state lead concentration. The reliability of the models for predicting lead concentrations for exposure durations shorter than three months has not been assessed. In order to address non-continuous exposures, the USEPA Office of Solid Waste and Emergency Response has developed a guidance document for evaluating intermittent exposures to lead for scenarios such as recreational users and trespassers.

Since the exposure frequency is less than three months, predicted intake values were compared with the provisional values discussed in Section 3.3.2. Table 3-11 presents the results of the lead intake calculations and lead screening. Only the ingestion pathway is quantified. No unacceptable human health impacts are anticipated from exposure to lead in soil at this site.

Table 3-11. Evaluation of Lead Exposures in Soil

EPC (mg/kg)		Intake (mg/kg/day)		Predicted Intake (mg/day)		Provisional Intake Value (mg/kg)		
CTE	RME	CTE	RME	CTE	RME	Child	Female	Male
Monte Cristo Mining Area - Combined								
5.4E+03	7.3E+03	4.6E-08	5.0E-07	2.5E-04	3.6E-03	6.0E-03	1.5E-02	7.5E-02
Near Features								
6.1E+03	7.9E+03	4.6E-08	5.0E-07	2.8E-04	3.9E-03	6.0E-03	1.5E-02	7.5E-02
Remote Features								
4.5E+03	9.3E+03	4.6E-08	5.0E-07	2.1E-04	4.6E-03	6.0E-03	1.5E-02	7.5E-02

Lead was also identified as a COPC in surface water because no PRG was available for screening. Many of the non-carcinogenic effects associated with lead may not exhibit a threshold, especially in young children. USEPA considers lead to be a B2 carcinogen. The maximum concentration of lead found in surface water (not adit/seep discharges) at the MCMA was 0.0008 mg/L. Water from adits/seeps were not considered a viable drinking water source in the MCMA. For purposes of this risk assessment, ingestion and dermal contact with surface water under normal "household" use was considered a complete pathway of exposure. Concentrations of lead in surface water at Near and Remote locations are lower than the Federal Action Level for lead (0.015 mg/L). Therefore, no unacceptable human health impacts are anticipated for lead in surface water.

3.5 Calculation of Cleanup Goals

Site-specific cleanup goals for soil and sediment protective of the RME (seasonal resident) at the Near locations and for soil protective of the RME (occasional visitor) at the Remote locations were calculated based on the regulatory standard of 1E-06 ECR. Site specific cleanup goals protective of the indirect pathway of fish ingestion were calculated for surface water. The site-specific cleanup goals are presented in Table 3-12.

Table 3-12. Preliminary Human Health Remediation Goals

Medium	Arsenic Cleanup Goal	Location	Basis
Soil / Waste Rock	67 mg/kg 659 mg/kg	Near Features Remote Features	Protection of RME Seasonal Resident - ingestion and dermal contact
Sediment	0.01 mg/kg	Near Features	Protection of RME Seasonal Resident - ingestion of fish
Surface Water	0.0008 µg/L	Near Features	Protection of RME Seasonal Resident - ingestion of fish

3.6 Summary of Human Health Risks

Unacceptable carcinogenic and noncarcinogenic risks were identified at the Site. Of the 22 COIs identified at the Site, antimony, arsenic, and lead were identified as major COPCs. Based on current and future land use, potential receptors were identified as individuals who might come in contact with Site-related contaminants through occasional recreational activities (i.e., hunting, hiking, and camping) or as seasonal residents.

Due to the remote nature of several of the mines, the Site was divided into Near and Remote features. Near features were defined as those close to the Townsite, and having fairly easy human access. Remote features are typified by difficult terrain, lack of amenities, infrequent use, and difficult access. The potential for significant activity is considered to be moderate to high at the Near features and very low at the Remote features.

The risk assessment determined that there are no unacceptable human health impacts from lead in surface water or in soil/waste rock. The maximum concentration of lead (0.0008 mg/L) found in surface water did not exceed the Federal Action Limit for lead in drinking water (0.015 mg/L). Predicted intakes of lead from ingestion of soil/waste rock did not exceed USEPA Provisional Intakes for any receptors.

The risk assessment determined that there were no unacceptable noncarcinogenic health effects expected from exposure to antimony in soil. Potentially unacceptable noncarcinogenic risks are likely from ingestion of arsenic in soil under RME exposure conditions for the seasonal resident at Near locations and ingestion of surface water under RME exposure conditions for the occasional visitor to the Remote locations. Unacceptable excess cancer risks are likely from ingestion of arsenic in soil under both exposure conditions for the seasonal resident and occasional visitor. Ingestion of sediment and surface water under RME exposure conditions are likely to results in unacceptable excess cancer risks for both occasional visitor and seasonal resident. Dermal contact with soil is likely to result in unacceptable excess cancer risk to occasional visitors to Remote locations.

Because the Site is a popular recreational area, the indirect pathway of fish ingestion was also considered a complete pathway. The impact of contaminants in surface water and sediments on fish tissue concentrations was evaluated to determine potential human health impacts from this pathway of exposure using an RBC screening approach. Site specific RBCs for surface water and sediment were calculated for Near location conditions. Fish ingestion was only considered at the Near locations. Fishing in the Remote locations is unlikely. There is little traffic in the Remote locations and fish barriers along the creeks make it unlikely that these areas would be used successfully for fishing. Sampling data were screened against these RBCs. Most of the samples collected exceeded the site-specific RBCs at both the Near and Remote locations. However, the RBCs for sediment and surface water only provide a snapshot of the potential worst case scenario for fish consumption and do not necessarily present a risk characterization of the Site.

4.0 ECOLOGICAL RISK ASSESSMENT

The goal of the ERA is to provide an ecological risk-based screening and determine whether unacceptable ecological risks are likely associated with COIs at the Site. An ecological survey was conducted as part of a previously completed SI (CES, 2007). The SI report documented ecological features and conditions at and near the Site. A Terrestrial Ecological Evaluation (TEE) was completed based on the ecological survey, in accordance with Ecology requirements (Ecology, 2007), and is provided in Appendix C. Based on the TEE, an exclusion from further terrestrial ecological evaluation is not acceptable and a site-specific terrestrial ERA is warranted. Ecology does not provide specific guidance for an ERA of water or freshwater sediment and specific methods are not prescribed for Site-specific ERA of soil. Therefore, risk-based screening methods appropriate for Ecology (2007) and the USEPA (1997c, 1999) were implemented to assess the potential for risks posed by Site-related COIs in surface soil, waste rock, tailings, surface water, pore water, and sediment. This report consists of the following:

- Problem Formulation
- Risk-Based Screening
- Risk Characterization (including Uncertainty Analysis)
- Summary of Ecological Risks

4.1 Problem Formulation

The scope of the ERA is defined through problem formulation. This step describes physical and chemical characteristics of the Site and the important ecological habitats, plants, invertebrates, fish, and wildlife that are present or likely to be present. This information is utilized to identify the ecological COIs and ecological receptors of concern, and to develop a conceptual ecological exposure model (CEEM). The CEEM depicts the expected fate and transport of COIs at the Site, the potential exposure media, and likely exposure pathways for ecological receptor groups of concern. The problem formulation concludes with identification of the ecological endpoints that delineate the focus (i.e., objectives) of the remainder of the ERA. Generally, problem formulation includes a description of the Site and summary of previous investigations. However, extensive versions of these have been provided in the SI and, therefore, are not repeated herein.

4.1.1 Ecological Stressors

Ecological receptors may be affected through exposure to chemicals (i.e., toxicity), physical stresses (i.e., destruction of habitat), and biological stresses (i.e., viruses and bacteria). While biological stressors may affect ecological receptors, they are more frequently associated with waste food or human waste and in areas where wildlife congregate in large numbers. Because the remote nature of the Site limits human presence and wastes, biological stresses are not considered to pose a threat. Due to the habitat types present at and surrounding the Site, ecological receptors are also unlikely to congregate in the vicinity of the Site in numbers that could result in significant biological infection or passage of wildlife diseases. Thus, biological stressors are unlikely to be a significant factor at the Site and are not considered further.

Past physical disturbances include the development of the Site and supporting structures, and mining activities. Much of the Site has been abandoned for decades, but some areas such as the former Monte Cristo Townsite receive occasional visitors during the spring, summer, and fall. In addition, some mining claims are still active with private individuals working the claims on an intermittent basis. Direct vehicle access to the Site is impossible, but all terrain vehicles can access the South Fork Sauk River downstream of the Monte Cristo Townsite. Current physical disturbance is limited to a low number of occasional visitors and individuals with mining claims accessing the Site on foot. Given the relatively remote nature of the Site within the Mt. Baker-Snoqualmie National Forest and the length of time since commercial mining has occurred, the ecological impacts due to physical disturbance are limited.

As described in Section 2.0, the primary COIs are metals. The COIs retained for the ERA are listed previously in Table 2-1.

4.1.2 Ecological Setting

The regional and Site-specific ecology, sensitive environments, and rare, threatened, and endangered (RTE) species were presented in the ecological survey report, which was part of the SI (CES, 2007).
In summary, the Site is comprised of three major plant communities including: 1) disturbed areas around the Monte Cristo Townsite and mine-related areas, 2) coniferous hemlock forest, and 3) alpine. Glacier Creek and Seventysix Gulch flow through the Site, meeting to form the South Fork Sauk River near the Monte Cristo Townsite. The relatively remote nature of the Site provides for diverse plant and wildlife populations.

The only documented (see Appendix D) rare plant in the vicinity was the state threatened Choris' bog-orchid (*Platanthera chorisiana*), which prefers sphagnum bogs and stream banks just above the water level, commonly found in association with mountain hemlock (*Tsuga Mertensiana*) and mountain heather (*Phyllodoce* sp) at elevations from 2,540 – 4,300 feet (774-1301 meters) above mean sea level. No threatened or endangered terrestrial wildlife were documented in the Washington Department of Fish and Wildlife (WDFW) priority habitats and species database search (Appendix D). However, threatened bull trout (*Salvelinus confluentus*) and threatened Puget Sound steelhead (*Oncorhynchus mykiss*) are documented in South Fork Sauk River, Glacier Creek, and Seventysix Gulch (Appendix D).

4.1.3 Conceptual Ecological Exposure Model

The CEEM depicts the sources of contamination, contaminant release and transport mechanisms, impacted exposure media, and exposure routes for ecological receptor types at the Site. The primary source of COIs are the tailings and waste rock piles. Based on previous investigations and current understanding of Site conditions, the potentially contaminated exposure media for ecological receptors are outlined in Figure 4-1 and include:

- Surface soil, tailings, and waste rock;
- Surface water in Glacier Creek, Seventysix Gulch, and South Fork Sauk River
- Pore water in Glacier Creek, Seventysix Gulch, and South Fork Sauk River
- Sediment in Glacier Creek, Seventysix Gulch, and South Fork Sauk River

Given these exposure media, terrestrial, aquatic, and benthic ecological receptor groups may be exposed to COIs as depicted in Figure 4-1.

4.1.4 Assessment Endpoints and Measures

Assessment endpoints are qualitative or quantitative expressions of the environmental values to be protected and, therefore, assessed in the ERA. As such, assessment endpoints link the ERA and risk management processes by highlighting ecological aspects that are of concern to risk managers. Assessment measures are characteristics of the Site, selected ecological receptors, or ecosystems that are measured through monitoring or sampling activities, and then related qualitatively or quantitatively to the selected assessment endpoint(s).

<u>Assessment Endpoints</u>

Within a screening level ERA such as this, assessment endpoints are generalized to reflect the risk-based screening process and protective ERBSCs. The assessment endpoints for this ERA include:

- Protection of the reproduction, growth, and survival of non-protected plant, invertebrates reptile, bird, and mammal populations exposed to COIs in soil, tailings, and waste rock;

- Protection of reproduction, growth, and survival non-protected aquatic life (including amphibians), birds, and mammals exposed to COIs and pH changes in surface water and pore water within Glacier Creek, Seventysix Gulch, and South Fork Sauk River;
- Protection of normal behavior of protected aquatic life (including amphibians), birds, and mammals exposed to COIs and pH changes in surface water and pore water within Glacier Creek, Seventysix Gulch, and South Fork Sauk River;
- Protection of reproduction, growth, and survival of non-protected benthic invertebrates, amphibians, birds, and mammals exposed to COIs in sediment within Glacier Creek, Seventysix Gulch, and South Fork Sauk River; and
- Protection of normal behavior of protected aquatic life (including amphibians), birds, and mammals exposed to COIs and pH changes in sediment within Glacier Creek, Seventysix Gulch, and South Fork Sauk River.

Assessment Measures

Assessment measures are used to evaluate the response of the indicator communities/species when exposed to a stressor. Generally, they are measurable ecological characteristics and define what samples and/or data will be collected to address the assessment endpoints. For this ERA, the assessment measures are comprised of the following:

- Measured concentrations of COIs in soil, waste rock, tailing, surface water, pore water, and sediment;
- Measured pH in water (including creek, river, adit discharge, and pore water); and
- Readily available ERBSCs available from Ecology guidance (Ecology, 2007) and other applicable guidance or published literature (e.g., ODEQ, 2001).

4.2 Ecological Risk-Based Screening

Ecological risk-based screening begins with the list of COIs remaining following the initial screening, as shown in Table 2-1. The EPCs are then compared to selected ERBSCs with consideration of chemical-specific bioaccumulation potential, reporting limit adequacy, and exposures to multiple chemicals and multiple media. The result is a list of Site-related contaminants of potential ecological concern (COPEC).

As described above in Section 3.2.3, the preferred EPCs used in the risk-based screening were the lower of the distribution-appropriate 95UCL or the maximum detected concentrations. If fewer than five samples were available, then the maximum detected concentration was used as the EPC. One-half the sample reporting limit was used in these calculations when a particular chemical was listed as not detected. The maximum sample reporting limit for a given chemical and medium was also included in the risk-based screening as a secondary EPC, to identify undetected COIs with elevated reporting limits that may be contributing to ecological risks. The EPCs for each medium are listed in Table 4-1. Appendices E1 through E4 show the risk-based screening input and results.

Table 4-1. EPCs for Ecological Exposure Media

COI	Surface Soil/Waste rock and Tailings	Surface Water	Pore Water	Sediment
	mg/kg	mg/L	mg/L	mg/kg
Aluminum	1.05E+04	4.87E-01	3.01E-02	1.59E+04
Antimony	2.41E+03	8.58E-03	5.91E-03	1.83E+01
Arsenic III	2.76E+02	1.33E-03	1.38E-04	3.19E-03
Arsenic V	5.04E+04	1.36E+00	9.33E-03	4.39E+02
Arsenic, total	2.35E+04	6.83E-01	8.13E-01	3.93E+02
Barium	1.55E+02	6.06E-03	--	8.96E+01
Beryllium	4.36E-01	--	--	2.07E-01
Cadmium	1.08E+01	4.95E-03	1.00E-03	1.49E+00
Chromium VI	--	--	2.00E-02	
Chromium, total	3.98E+01	--	--	4.53E+01
Cobalt	7.03E+00	7.91E-03	--	1.15E+01
Copper	7.14E+02	2.46E-01	5.00E-03	9.11E+01
Iron	7.81E+04	1.02E+01	--	2.97E+04
Lead	7.93E+03	4.70E-02	2.00E-04	1.09E+02
Manganese	8.18E+02	9.73E-01	--	9.92E+02
Mercury	3.61E+00	8.37E-05	1.02E-06	9.40E-01
Mercury, Methyl	4.00E-02	--	--	1.70E-05
Nickel	2.11E+01	--	--	5.23E+01
Selenium	2.23E+00	3.00E-04	--	--
Silver	8.81E+01	8.65E-04	2.5E-03	1.72E+00
Thallium	5.20E+00	3.60E-04	--	2.00E-01
Vanadium	3.52E+01	--	--	6.09E+01
Zinc	1.32E+03	1.05E+00	6.07E-03	2.22E+02

NOTE:
Abbreviations: -- = Not selected as a COPEC; mg/L = milligrams per liter; mg/kg = milligrams per kilogram

The preferred soil and water ERBSCs used in the risk-based screening were U.S. EPA and Ecology ecological soil screening values (USEPA, 2005a, b, c, d, e, f, g, h, i, j, 2006b, 2007a, b, c, d, e, and 2008; Ecology, 2007) and Washington water quality standards (Ecology, 2006). When one of these ERBSCs was not available for a COI in soil or water, and for sediment, ERBSCs were selected from those provided by ODEQ (2001), other similarly accepted risk-based screening concentrations (e.g. CCME, 1999, Persaud et al. 1993), or an ERBSC for a surrogate chemical was substituted when deemed appropriate. Exceptions to the preferred ERBSCs and the use of surrogates are referenced in Appendix A, Table A-1. Washington State Sediment Management Standards (Ecology, 1995) do not specifically describe methods for assessing freshwater sediment quality. The risk-based screening being conducted herein, for sediment, mirrors the process described by Ecology for marine sediments, with the substitution of selected ERBSCs for the numeric sediment quality standards. These sediment ERBSCs are predominantly from ODEQ (2001) ecological risk assessment guidance, and are comprised of concentrations from various sources that are developed similarly to those used by Ecology for marine sediment quality standards and those discussed in recent Ecology (2009) research into defining freshwater sediment reference sites. As necessary, further site-specific ecological risk assessment will use approaches compatible with Model Toxic Control Act and the sediment management standards and acceptable to Ecology.

The EPCs were compared to the medium and receptor group-specific ERBSCs to calculate chemical-specific risk ratios (R_{ij}), receptor group risk ratios (R_j; the sum of the chemical-specific risk ratios), and each COI was examined for the potential to bioaccumulate, for elevated reporting limits, and to determine whether it contributed an inordinate amount to the receptor group risk. Risk ratios greater than 1 indicate unacceptable risks. The COIs for which potential ecological risks are indicated become the COPECs. The results of the

ecological risk-based screening were media-specific lists of the COPECs (denoted by "X") shown in Table 4-2. The risk ratios and number of samples for each COPEC with concentrations that exceeded acceptable risk ratios are shown in Tables 4-3 through 4-6.

Table 4-2. Selected Contaminants of Potential Ecological Concern

COI	Surface Soil, Waste Rock, Tailings	Surface Water	Pore Water	Sediment
Aluminum	X[1]	X[1,2]		X[3]
Antimony	X[1,3,5]	X[3]	X[3]	X[1]
Arsenic III	X[1,2]	X[2]	X[2]	
Arsenic V	X[1,2,4]	X[1,2]	X[2]	X[1,4]
Arsenic, total	X[1,2,4]	X[1,2]	X[1,2,4]	X[1,4]
Barium	X[1]	X[1]		X[3]
Beryllium	X[3]			X[3]
Cadmium	X[2]	X[1,2,5]	X[5]	X[1,4]
Chromium VI			X[1,2,4]	
Cobalt	X[3]	X[3]		X[3]
Copper	X[1]	X[1,4,5]	X[5]	X[1,4]
Iron	X[1,2,4]	X[1,3]		
Lead	X[1,2]	X[1,2,4,5]	X[2,4,5]	X[1,4]
Manganese	X[1]	X[1]		
Mercury	X[1,2]	X[1,2,5]	X[2]	X[1,2,3]
Mercury, Methyl	X[1,3]			X[3]
Nickel				X[1]
Selenium	X[1,2,5]	X[2]		
Silver	X[1,3]	X[1,3,5]	X[3,5]	
Thallium	X[1,3,5]	X[3]		X[3]
Vanadium	X[1,3]			X[3]
Zinc	X[1]	X[1,4]		X[1,4]

NOTES:
X – Selected as COPEC
1 – Selected as a COPEC due to exceedance of an ERBSC.
2 – Selected as a COPEC due to a potential for bioaccumulation.
3 – Selected as a COPEC because no ERBSC was available.
4 – Selected as a COPEC because of inordinate contribution to overall risk.
5 – Selected as a COPEC because of an elevated reporting limit.

Table 4-3. Risk Ratios for Surface Soil, Waste Rock, and Tailings

COPEC	Terrestrial Plants (R_{ij})	n/N	Terrestrial Invertebrates (R_{ij})	n/N	Birds (R_{ij})	n/N	Mammals (R_{ij})	n/N
Aluminum	**209**	1/52	**17**	1/52	**23**	1/52	**98**	1/52
Antimony	**483**	78/90	**31**	59/90	No ERBSC		**161**	73/90
Arsenic III	**28**	6/7	**5**	6/7	**39**	6/7	**39**	6/7
Arsenic V	**5,042**	7/7	**840**	6/7	**382**	6/7	**382**	6/7
Arsenic, total	**1,036**	87/93	**392**	87/93	**3,358**	87/93	**3,358**	87/93
Barium	0.3	0/52	0.5	0/52	2	8/52	2	8/52
Beryllium	0.04	0/61	0.01	0/61	No ERBSC		0.005	0/61
Cadmium	0.3	3/92	0.08	0/92	0.8	0/92	0.8	0/92
Cobalt	0.5	0/52	0.007	0/52	No ERBSC	0/52	0.05	0/52
Copper	**10**	79/93	**9**	78/93	3	52/93	**3**	52/93
Iron	**7,810**	47/55	**390**	47/55	No ERBSC		No ERBSC	
Lead	**66**	79/93	**5**	49/93	**67**	79/93	**67**	79/93
Manganese	**4**	6/52	**2**	6/52	0.5	0/52	0.5	0/52
Mercury	**12**	60/90	**36**	60/90	0.7	0/90	0.7	0/90
Mercury, Methyl	**200**	3/3	No ERBSC		0.1	0/3	0.1	0/3
Selenium	**4**	67/90	0.5	0/90	**7**	67/90	**7**	67/90
Silver	0.2	0/90	**2**	24/90	No ERBSC		No ERBSC	
Thallium	**5**	40/61	**5**	40/61	No ERBSC		5	40/61
Vanadium	**18**	6/52	No ERBSC		0.7	0/52	1	0/52
Zinc	**8**	67/93	**11**	75/93	4	39/93	**4**	39/93
Total Receptor Group Risk (R_i)	**15,208**		**1,747**		**3,889**		**4,130**	

Table 4-4. Risk Ratios for Surface Water

COPEC	Aquatic Life (R_{ij})	n/N	Birds (R_{ij})	n/N	Mammals (R_{ij})	n/N
Aluminum	**6**	1/9	0.0006	0/9	0.06	0/9
Antimony	0.005	0/49	No ERBSC		0.009	0/49
Arsenic III	0.009	0/5	0.00007	0/5	0.0002	0/5
Arsenic V	**9**	1/5	0.08	0/5	0.2	0/5
Arsenic, Total	**4**	7/56	0.04	0/5	0.1	0/5
Barium	**2**	2/9	0.00004	0/9	0.0002	0/9
Cadmium	**31**	2/51	0.0005	0/51	0.0006	0/51
Cobalt	0.3	0/9	No ERBSC		0.0009	0/9
Copper	**183**	37/56	0.0007	0/56	0.005	0/56
Iron	**10**	7/25	No ERBSC		No ERBSC	
Lead	**307**	16/56	0.002	0/56	0.0001	0/56
Manganese	**8**	5/20	0.0001	0/20	0.001	0/20
Mercury	**7**	13/44	0.00003	0/44	0.000008	0/44
Selenium	0.06	0/34	0.000	0/34	0.0002	0/34
Silver	**7**	11/42	No ERBSC		No ERBSC	
Thallium	0.009	0/17	No ERBSC		0.006	0/17
Zinc	**83**	17/56	0.01	0/56	0.0009	0/56
Total Receptor Group Risk (R_i)	**656**		0.1		0.4	

Table 4-5. Risk Ratios for Pore Water

COPEC	Aquatic Life (R_{ij})	n/N	Birds (R_{ij})	n/N	Mammals (R_{ij})	n/N
Antimony	0.004	0/13	No ERBSC		0.006	0/13
Arsenic III	0.0009	0/5	0.00008	0/5	0.00002	0/5
Arsenic V	0.06	0/5	0.0005	0/5	0.002	0/5
Arsenic, Total	**4**	1/13	0.05	0/13	0.1	0/13
Cadmium	Elevated Reporting Limit	2/13	0		0	
Chromium VI	**2**	1/1	0.003	0/1	0.0008	0/1
Lead	1	0/13	0.000007	0/13	0.0000006	0/13
Mercury	0.08	0/13	0.0000003	0/13	0.0000001	0/13
Silver	Elevated Reporting Limit	6/13	0		0	
Total Receptor Group Risk (R_j)	**9**		0.05		0.1	

Table 4-6. Risk Ratios for Sediment

COPEC	Benthic Invertebrates (R_{ij})	n/N	Birds and Mammals (R_{ij})	n/N
Aluminum	No ERBSC		No ERBSC	
Antimony	**6**	27/37	2	12/37
Arsenic, V	**73**	7/7	**110**	7/7
Arsenic, Total	**66**	33/37	**98**	33/37
Barium	No ERBSC		No ERBSC	
Beryllium	No ERBSC		0.002	0/8
Cadmium	**2**	18/37	**495**	18/37
Cobalt	No ERBSC		No ERBSC	
Copper	**3**	31/37	**9**	34/37
Lead	**3**	24/37	0.8	0/37
Mercury	**5**	1/20	No ERBSC	
Mercury, Methyl	No ERBSC		No ERBSC	
Nickel	**3**	1/8	0.2	0/8
Thallium	No ERBSC		0.3	0/8
Vanadium	No ERBSC		No ERBSC	
Zinc	**2**	14/37	**74**	35/37
Total Receptor Group Risk (R_j)	**166**		**21**	

NOTES (for Tables 4-3 to 4-6):
Bold = COPECs with risk ratio greater than acceptable levels (i.e., >1).
Abbreviations: n = number of exceedances of an ERBSC and background, N = Number of samples.

Based on the extent and number of samples with unacceptable predicted risks, the ecological risk-based screening results indicate a potential for ecological risk due to metals in soil, waste rock, and tailings (primarily aluminum, antimony, arsenic V, total arsenic, copper, iron, lead, mercury, methyl mercury, vanadium, and zinc); metals in surface water (primarily cadmium, cadmium, copper, iron, lead, and zinc); metals in pore water (but only total arsenic and chromium VI have unacceptable risk ratios); and metals in sediment (primarily , arsenic V, total arsenic, and cadmium). Aluminum, antimony, arsenic III, arsenic V, total arsenic, barium, cadmium, copper, iron, lead, mercury, silver, and zinc were the COPECs that exceeded ERBSCs in two or more media. The COPECs with risk ratios greater than 10 were aluminum, antimony, arsenic III, arsenic V, total arsenic, copper, iron, lead, mercury, methyl mercury, vanadium, and zinc in soil and waste rock; cadmium, copper, iron, lead, and zinc in surface water; and arsenic V, total arsenic,

cadmium, and zinc in sediment. The results of the ecological risk-based screening are discussed further in Section 4.3.

The pH of waste rock samples were predominantly between 3 and 6 standard units (s.u.). This acidity may promote the mobilization of metals through the waste rock, and into the food chain. The pH of adit seeps/discharges varies at the Site, with the Mystery Mine, Pride of the Woods Mine, and possibly the Justice Mine having pH consistently less than 6 s.u. and as low as 3.5 s.u. Of these, the only mine water flowing directly to surface water is the seep at the Pride of the Woods. The pH of surface water samples from the creeks and river are between 6 and 8 s.u., suggesting that the mine drainage is not significantly affecting surface water pH.

4.3 Ecological Risk Characterization

The ecological risk characterization includes a description of risk and an uncertainty analysis. In the discussions below, a lack of background/reference concentrations for an analyte may have been the result of no analysis of background samples, or due to non-detect analytical results, for that analyte.

4.3.1 Risk Description

Ecological risk description involves examining the predicted risks to determine whether they are likely, or artifacts of the risk assessment process.

Surface Soil, Waste rock, and Tailings

The COPECs for surface soil, waste rock, and tailings are listed in Table 4-3. Beryllium and cobalt were selected due solely to the lack of an ERBSC for birds. Beryllium concentrations exceeded the background concentration by more than a factor of two in only two samples (CON-14 and CON-18 at the concentrator) and cobalt concentrations exceeded the background concentration by a factor of more than two at only one sample location (CON-14). Aluminum was selected as a COPEC due to exceedances of the ERBSCs at only one sample location (CON-18), and no other samples had aluminum concentrations that exceeded background concentrations. Barium exceeded wildlife ERBSCs at eight locations, all from near the Concentrator. Cadmium was selected as a COPC solely because of its potential to bioaccumulate. Of the six samples in which manganese exceeded ERBSCs, three were at the concentrator (CON-14 and CON-16), two were at the ore collector (COL-01-2 and COL-01-1), and one was at the Mystery Mine (MM-04-0.5 Manganese risks were predicted for invertebrates only at six locations, all but one (at Mystery Mine) of which were at the concentrator or the collector. Vanadium risks were predicted for invertebrates only at the Concentrator, Haulage Ways, and Mystery Mine. So, the risks predicted for aluminum, barium, beryllium, cobalt, cadmium, manganese, and vanadium were a result of either a prediction of bioaccumulation or unacceptable concentrations at the Concentrator, Collector, Haulage Ways, and Mystery Mine.

Given consideration of the extent and number of exceedances of background concentrations and ERBSCs, and a lack of ERBSCs, for antimony, arsenic III, arsenic V, total arsenic, copper, iron, lead, mercury, methyl mercury, selenium, silver, and zinc in soil, it seems likely that their concentrations in soil, waste rock, and tailings are high enough to result in ecological risks if significant exposure occurs. The pH at many of the waste rock areas is relatively low; suggesting some metals such as zinc may be mobile from the source areas and in the food chain. The most significant risk would be posed to plants and invertebrates growing within the relatively small contaminated areas (compared to surrounding uncontaminated areas). More mobile and wide-ranging wildlife species are unlikely to spend large amounts of time on or around the waste rock and tailings piles and, thus, are less likely to be impacted by the COPECs.

Surface Water

The COPECs for surface water were listed in Table 4-4. Unacceptable risks were predicted for aquatic life, but not for birds or mammals, due to multiple COPECs. Arsenic III and selenium were selected as COPECs solely due to the potential to bioaccumulate. No background/reference concentrations were available for these two COPECS, so comparisons were not possible.

Antimony, cobalt, and thallium were all selected because of the lack of an ERBSC. Antimony exceeded background concentrations by a factor of more than 2 in 13 of 49 samples. Ten of these were at adit seeps near mine-related locations (i.e., not in creek or river samples). The remaining three were collected from Glacier Creek, but were the result of elevated reporting limits for non-detected results. Cobalt was detected in one of nine collected samples, at the Mystery adit #3. Thallium is similar to cobalt in that only 1 of 17 samples collected at the Mystery Mine adit seep had a detected concentration. Thus, any potential risks for these COPECs are limited to adit/waste rock seeps.

Aluminum, arsenic V, cadmium, manganese, total arsenic, iron, and zinc exceeded ERBSCs at 1 to 17 sample locations. All of these were at adit/waste rock seeps. Barium exceeded ERBSCs at two Glacier Creek sample locations, but the barium concentrations at these locations were identical and both above background by a factor of 1.3. Copper appears to exceeded ERBSCs at 37 of 56 samples. However, most of these apparent exceedances are due to elevated reporting limits for undetected concentrations. Examining the detected concentrations, there is one exceedance of an ERBSC in the South Fork Sauk River at station MCEE-SW-SFSR-04 and 13 exceedances at adit/waste rock seeps. Similarly, lead and silver appear to have multiple ERBSC exceedances in the creeks and South Fork Sauk River; however, examination of the detected concentrations for lead indicates one exceedance in Seventysix Gulch and three at or below Monte Cristo Lake, with 14 exceedances at adit/waste rock seeps. For silver, there were 4 exceedances at adit/waste rock seeps.

The pH of surface water is within normal ranges suggesting that mine-related pH impacts are not occurring in Glacier Creek, Seventysix Gulch, and the South Fork Sauk River. However, the low pH in waste rock may allow mobilization of metals via overland or subsurface transport.

Pore Water

The COPECs for pore water in the creeks and river are shown in Table 4-5. Antimony was chosen as a COPEC due to the lack of a bird ERBSC. No antimony background/reference concentration was available for comparison to site-related concentrations. Arsenic III, arsenic V, and mercury had no ERBSC exceedances but were chosen as COPECs due to their potential to bioaccumulate. No arsenic III or arsenic V background/reference concentration was available for comparison to site-related concentrations. Only one of the mercury concentrations exceeded the respective mercury background concentrations, by a factor of 1.2.

Silver was selected as a COPEC due to elevated reporting limits in 6 of 13 samples and also did not have a background/reference concentration available. Cadmium and lead were selected due to elevated reporting limits in 2 and 6 of 13 samples, respectively, and due to the potential to bioaccumulate, but also had no background/reference concentrations for comparison.

Out of 13 samples, total arsenic exceeded its aquatic life ERBSC at 1 Monte Cristo Lake sample location. Chromium VI exceeded the aquatic life ERBSC in the only sample analyzed (collected from Glacier Creek) for this COPEC. However, this chromium VI concentration was determined using a field measurement tool and laboratory-measured total chromium was not detected in this or any other pore water sample, all with reporting limits less than the field measured chromium VI concentration. This suggests chromium VI is not a COPEC in pore water.

The pH of pore water is within the normal range. This suggests that mine-related pH impacts are not occurring in pore water.

Sediment

The COPECs for sediment are shown in Table 4-6. Aluminum, barium, beryllium, cobalt, methyl mercury, thallium, and vanadium were selected as COPECs due to a lack of ERBSCs. None of the detected concentrations of aluminum or barium exceeded the background concentrations measured for the Site. Beryllium, cobalt, iron, and thallium concentrations did not exceed background by more than a factor of two. Methyl mercury had no background concentration for comparison.

Similarly, zinc concentrations exceeded invertebrate and wildlife ERBSCs at multiple stations, but only exceeded background concentrations by a factor of more than two at one station. Mercury and nickel exceeded their invertebrate ERBSC and the background concentration at one station each and antimony, arsenic V, total arsenic, cadmium, copper, and lead had multiple exceedances of the invertebrate and/or wildlife ERBSCs and background concentrations in adit/waste rock seeps, Glacier Creek, Seventysix Gulch, and/or the South Fork Sauk River.

4.3.2 Uncertainty Analysis

The primary uncertainties associated with this ecological risk-based screening and the effects on the ecological risks predictions are discussed below. This information is combined with that provided above in the risk description section to provide conclusions and recommendations regarding ecological risks.

Analytical Data

The analytical data for soil, waste rock, and tailings are from samples collected in areas of known and suspected high contamination. This results in an overestimation of the potential chemical exposure of all species except those that are immobile, such as plants and invertebrates, and exposed to the COPECs. Even in these cases, only individuals among the receptor population are likely to be impacted, which is critical only for protected species. More mobile species are exposed over a wider area that has lower concentrations or none of the site-related chemicals. Thus, the calculated risks overestimate the actual risks posed to upper trophic level species (i.e., bird and mammals).

Risk-Based Screening Procedures

The use of maximum detected concentration or 95UCL as the EPC is a conservative approach that is purposefully designed to result in some overestimation of the potential ecological risks. Because of this, the risks predicted are likely to overestimate actual ecological risks at the Site.

Including a maximum sample reporting limit screening is a conservative approach that includes COIs as COPECs when they are actually not detected at elevated concentrations. Because the undetected COI is likely present at concentrations less than the reporting limit, including the COI as a COPEC, results in an overestimation of the potential for ecological risks.

Using a regulatory standard for risk ratios of 1.0 provides a very protective threshold for ecological receptors, likely resulting in an overestimation of ecological risks. This risk threshold assumes that populations of ecological receptors are exposed to site-related contamination 100% of the time. In reality, only individual plants, and possibly invertebrates, may be exposed in this manner because other receptors move on and off the contaminated sites, only exposed to site-related contaminants some variable fraction of the time. Thus, with reduced exposure, reduced risk follows. Exceptions to this conservatism are threatened or endangered species that should be considered on an individual basis.

Ecological Data Gaps

The lack of ERBSCs for some receptors precludes the calculation of risk for those receptors. This may result in over- or underestimation of the potential for ecological risks.

Ecotoxicological Data

Many of the ERBSCs used for this ERA (other than aquatic life and benthic invertebrates) are intended to be no-observed-adverse-effect-level (NOAEL). Because actual ecological effects occur at an unknown concentration somewhere between the NOAEL and the LOAEL, simply exceeding an ERBSC does not necessarily indicate the potential for significant ecological effects. Thus, the use of NOAEL-based ERBSCs likely results in an overestimation of the potential for ecological risk.

4.4 Summary of Ecological Risks

Unacceptable concentrations of at least one of several COPECs are present in most of the soil, waste rock, and tailings samples collected from the Site, and it is likely that individual plants and invertebrates are impacted within these localized areas. Hot spots of contamination also were present in many samples. Given the highest unacceptable risk ratios and their more widespread distribution, antimony, arsenic III, arsenic V, total arsenic, copper, lead, mercury, selenium, and silver have the most potential to be causing any terrestrial ecological risks. Given their proximity, the waste rock and tailings piles are likely past and current sources for chemicals to be transported primarily to Glacier Creek and, to a lesser extent to Seventysix Gulch, both of which flow into the South Fork Sauk River.

While there are unacceptable concentrations of COPECs for aquatic life in adit/waste rock seeps, because the seeps are very small and not suitable for most aquatic life, aquatic life populations of concern are unlikely to be at risk due to direct exposure to COPEC in the seeps. However, barium, lead, mercury, and possibly silver were each present at unacceptable concentrations in Glacier Creek, Seventysix Gulch, and/or the South Fork Sauk River, indicating that mine-related COPECs from the adit/waste rock seeps are being contributed to the streams. Elevated concentrations of several COPEC were more consistently noted in the GC-03, GC-04, and GC-05 sample locations and their vicinity than in other locations.

In sediment, antimony, arsenic V, total arsenic, cadmium, copper, and lead had multiple unacceptable exceedances of the invertebrate and/or wildlife ERBSCs and background concentrations in adit/waste rock seeps, Glacier Creek, Seventysix Gulch, and/or the South Fork Sauk River. Antimony and total arsenic were particularly prevalent in sediment, with unacceptable concentrations extending as far downstream as Monte Cristo Lake. The very few number of unacceptable concentrations of COPECs in pore water suggests that the COPECs may be bound fairly tightly to sediment.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The MCMA covers a diverse topographical area along several miles of Glacier Creek and Seventysix Creek. Mine and facilities were divided into Near and Remote features based on proximity to the Townsite and relative accessibility. Occasional visitors and seasonal residents were identified as likely human receptors for the Near features, while occasional visitors were identified as the likely human receptors for the Remote features. Concentrations of lead in soil and surface water, and antimony in soil are not expected to result in unacceptable human health effects. Arsenic was identified as the only human health COPC. Potential unacceptable health impacts from ingestion of and skin contact with arsenic contaminated soils, sediment, and surface water under some exposure conditions may be present at the Site. Total ECRs exceeded Ecology's regulatory standard of 1E-06. With the exception of one sediment sample (MCEE-SS-MCL-06 = 0.281 mg/kg), concentrations of arsenic in surface water and sediment exceeded the RBCs for the fish ingestion pathway for both RME and CTE exposure scenarios. However, these fish consumption RBCs

provide only a snapshot of the potential worst case scenario and do not necessarily present a risk characterization of the Site. More detailed risk assessment is needed to accurately determine the risk associated with consumption of fish in the MCMA.

Arsenic concentrations, in general, are high in soil, waste rock, tailings, and sediment. The following table presents the recommended preliminary risk-based cleanup goals and the critical pathway of concern for protection of human health.

Preliminary Risk-Based Human Health Cleanup Goals

Medium	Arsenic Cleanup Goal	Location	Basis
Soil / Waste Rock	67 mg/kg 659 mg/kg	Near Features Remote Features	Protection of RME Seasonal Resident - ingestion and dermal contact
Sediment	0.01 mg/kg	Near Features	Protection of RME Seasonal Resident - ingestion of fish
Surface Water	0.0008 µg/L	Near Features	Protection of RME Seasonal Resident - ingestion of fish

Based on the information presented in the ERA, significant ecological impacts are expected for individual plants and invertebrates exposed to Site-related COPECs in soil, waste rock, and tailings near the adits, mines, and mine-related areas. These risks assume 100 percent exposure of the ecological receptors to the contaminated areas, which is unlikely. A site-specific risk assessment would be required to better define actual risks posed to ecological receptors. A definite potential for risk was predicted for aquatic receptors exposed to COPECs in adit/waste rock seeps. There were very few COPECs that exceeded aquatic life ERBSCs in the creeks and rivers, but a few of the COPECs may bioaccumulate into the aquatic food chain. Numerous very high unacceptable risks were calculated for invertebrates and wildlife exposed to COPECs in sediment, particularly for antimony and total arsenic. These sediment risks appear to extend several miles downstream from the Site. Further, more detailed assessment is recommended for aquatic ecological receptor exposure and risk due to COPECs in surface water and sediment.

The pattern of risk reinforces the transport and fate pathways shown in the CEEM, with mine adits and waste rock and adit/waste rock seeps contributing a vast majority of the predicted risks. Because of this, ecological protective remedial actions, particularly at the concentrator, collector, and haulage ways, would dramatically reduce the predicted risks and reduce the potential for further contribution of COPECs to the creeks and rivers.

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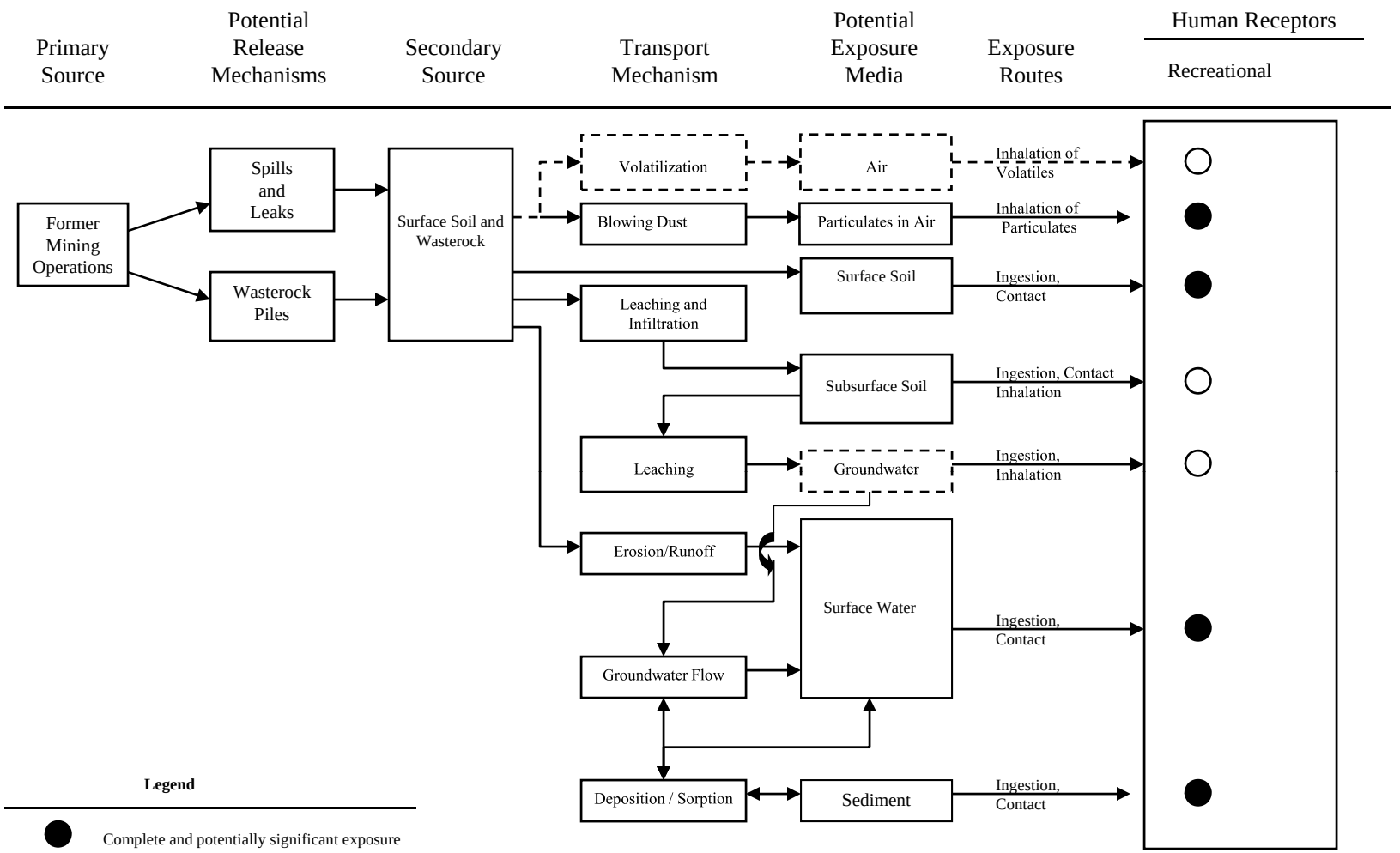
FIGURES

Figure 3-1. **Conceptual Human Health Exposure Model**
Figure 4-1. **Conceptual Ecological Exposure Model**



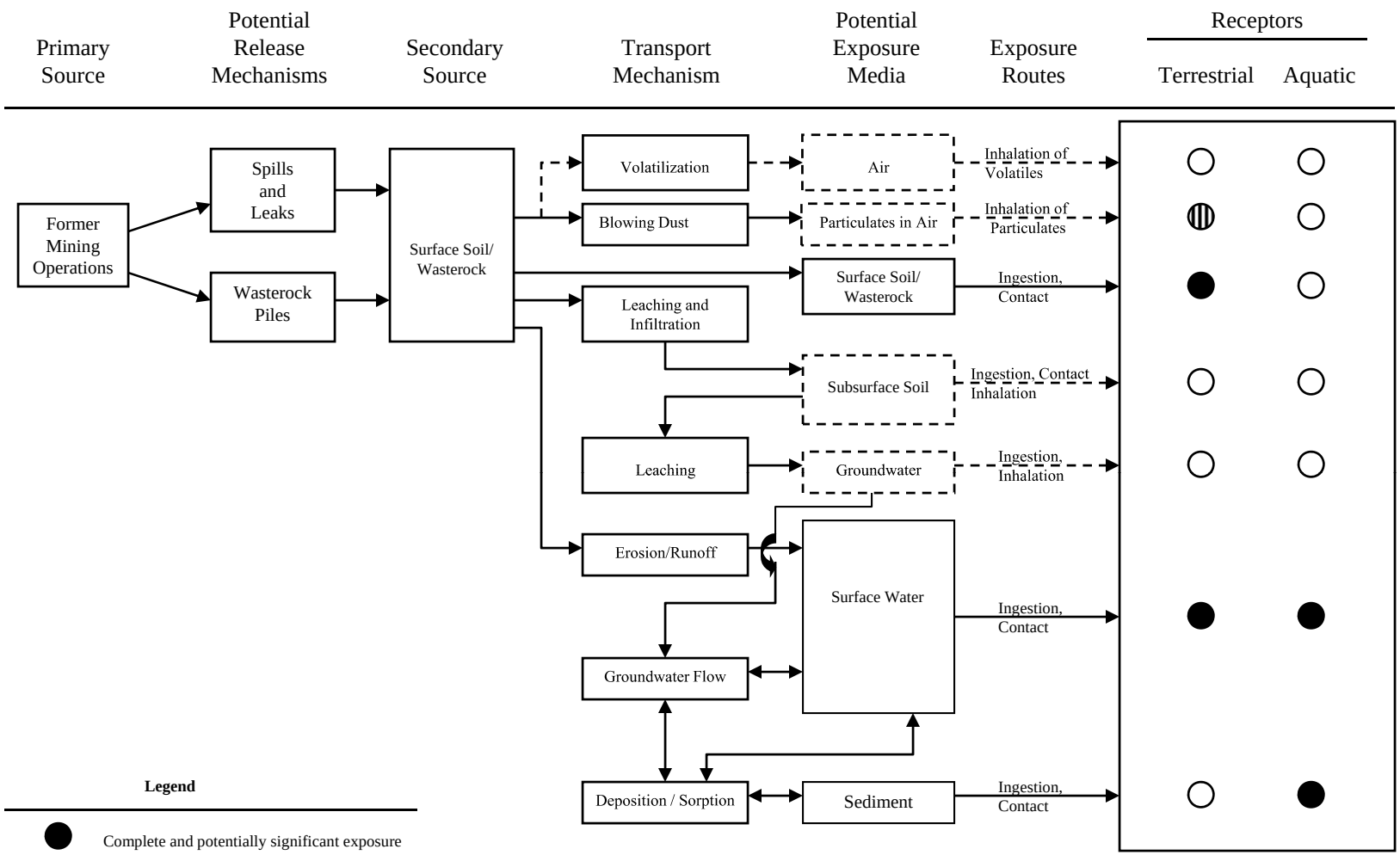
Legend

- Complete and potentially significant exposure
- Potentially Complete but insignificant exposure (not to be quantified)
- Incomplete Exposure (not to be quantified)
- Insignificant or Incomplete Pathway or Medium
- Complete and/or Significant Pathway or Medium

Figure

Conceptual Human Exposure Model

Monte Cristo Mining Area
Mt. Baker-Snoqualmie National Forest



Legend

- ● Complete and potentially significant exposure
- ◍ Potentially Complete but insignificant exposure (not to be quantified)
- ○ Incomplete Exposure (not to be quantified)
- - - Insignificant or Incomplete Pathway or Medium
- — Complete and/or Significant Pathway or Medium

Figure 4-1

Conceptual Ecological Exposure Model

Monte Cristo Mining Area
Mt. Baker-Snoqualmie National Forest
Snohomish County, Washington

APPENDICES

Appendix A.	**Initial Screening Results**
Appendix B.	**Human Health Risk Calculations**
Appendix C.	**Terrestrial Ecological Evaluation**
Appendix D.	**Rare, Threatened, and Endangered Species**
Appendix E.	**Ecological Risk-Based Screening Tables**

Appendix A.

Initial Screening Results

Appendix A1. Ecological Risk-Based Screening Concentrations
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Screening Level Values for Plants	Soil Screening Level Values			Freshwater Screening Level Values			Freshwater Sediment Screening Level Values	Sediment Bioaccumulation Screening Level Values
		Invertebrates	Birds	Mammals	Aquatic Life	Birds	Mammals		
	mg/kg				mg/L			mg/kg	
Aluminum	5.0E+01 Ecology, 2007	6.0E+02 ODEQ, 2001	4.5E+02 ODEQ, 2001	1.07E+02 ODEQ, 2001	8.70E-02 ODEQ, 2001	7.97E+02 ODEQ, 2001	8.00E+00 ODEQ, 2001	No Data	No Data
Antimony	5.0E+00 Ecology, 2007	7.80E+01 USEPA, 2005	No Data	1.50E+01 ODEQ, 2001	1.60E+00 ODEQ, 2001	No Data ODEQ, 2001	1.00E+00 ODEQ, 2001	3.00E+00 ODEQ, 2001	1.00E+01 ODEQ, 2001
Arsenic III	1.0E+01 ODEQ, 2001	6.0E+01 ODEQ, 2001	7.0E+00 Ecology, 2007	7.0E+00 Ecology, 2007	1.50E-01 ODEQ, 2001	1.80E+01 ODEQ, 2001	6.00E+00 ODEQ, 2001	6.00E+00 ODEQ, 2001	4.00E+00 ODEQ, 2001
Arsenic V	1.0E+01 Ecology, 2007	6.0E+01 Ecology, 2007	1.3E+02 Ecology, 2007	1.3E+02 Ecology, 2007	1.50E-01 ODEQ, 2001	1.80E+01 Arsenic III	6.00E+00 Arsenic III	6.00E+00 Arsenic III	4.00E+00 Arsenic III
Arsenic, Total	1.8E+01 USEPA, 2005	6.0E+01 Arsenic III	7.0E+00 Arsenic III	7.0E+00 Arsenic III	1.90E-01 Ecology, 2006	1.80E+01 Arsenic III	6.00E+00 Arsenic III	6.00E+00 Arsenic III	4.00E+00 Arsenic III
Barium	5.0E+02 Ecology, 2007	3.3E+02 USEPA, 2005	1.0E+02 Ecology, 2007	1.0E+02 Ecology, 2007	4.00E-03 ODEQ, 2001	1.50E+02 ODEQ, 2001	3.90E+01 ODEQ, 2001	No Data	No Data
Beryllium	1.0E+01 Ecology, 2007	4.0E+01 USEPA, 2005	No Data	8.3E+01 ODEQ, 2001	5.30E-03 ODEQ, 2001	No Data	No Data	No Data	1.22E+02 ODEQ, 2001
Cadmium	3.2E+01 USEPA, 2005	1.4E+02 USEPA, 2005	1.4E+01 Ecology, 2007	1.4E+01 Ecology, 2007	1.62E-04 Ecology, 2006[1]	1.00E+01 ODEQ, 2001	8.00E+00 ODEQ, 2001	6.00E-01 ODEQ, 2001	3.00E-03 ODEQ, 2001
Chromium III	1.0E+00 ODEQ, 2001	4.0E-01 ODEQ, 2001	6.7E+01 Chromium, Total	6.7E+01 Chromium, Total	2.30E-02 Ecology, 2006[1]	7.20E+00 ODEQ, 2001	2.10E+04 ODEQ, 2001	3.70E+01 Chromium, Total	4.20E+03 Chromium, Total
Chromium VI	1.0E+00 Chromium III	4.0E-01 Chromium III	6.7E+01 Chromium, Total	6.7E+01 Chromium, Total	1.00E-02 Ecology, 2006	7.20E+00 Chromium III	2.50E+01 ODEQ, 2001	3.70E+01 ODEQ, 2001	4.20E+03 ODEQ, 2001
Chromium, Total	4.2E+01 Ecology, 2007	4.2E+01 Ecology, 2007	6.7E+01 Ecology, 2007	6.7E+01 Ecology, 2007	2.30E-02 Chromium III	7.20E+00 Chromium III	2.50E+01 Chromium VI	3.70E+01 Chromium, Total	4.20E+03 Chromium, Total
Cobalt	1.3E+01 USEPA, 2005	1.0E+03 ODEQ, 2001	No Data	1.5E+02 ODEQ, 2001	2.30E-02 ODEQ, 2001	No Data	9.00E+00 ODEQ, 2001	No Data	No Data
Copper	7.0E+01 USEPA, 2007	8.0E+01 USEPA, 2007	2.2E+02 Ecology, 2007	2.17E+02 Ecology, 2007	1.34E-03 Ecology, 2006[1]	3.41E+02 ODEQ, 2001	5.30E+01 ODEQ, 2001	3.60E+01 ODEQ, 2001	1.00E+01 ODEQ, 2001
Cyanide	No Data	No Data	No Data	No Data	5.20E-03 Ecology, 2006	No Data	No Data	No Data	No Data
Iron	1.0E+01 ODEQ, 2001	2.0E+02 ODEQ, 2001	No Data	No Data	1.00E+00 Ecology, 2006	No Data	No Data	4.00E+04 Persaud et al., 1993	No Data
Lead	1.2E+02 USEPA, 2005	1.7E+03 USEPA, 2005	1.2E+02 Ecology, 2007	1.2E+02 Ecology, 2007	1.53E-04 Ecology, 2006[1]	2.80E+01 ODEQ, 2001	3.23E+02 ODEQ, 2001	3.50E+01 ODEQ, 2001	1.28E+02 ODEQ, 2001
Manganese	2.2E+02 USEPA, 2007	4.5E+02 USEPA, 2007	1.5E+03 Ecology, 2007	1.5E+03 Ecology, 2007	1.20E-01 ODEQ, 2001	7.24E+03 ODEQ, 2001	6.76E+02 ODEQ, 2001	1.10E+03 ODEQ, 2001	No Data
Mercury	3.0E-01 Ecology, 2007	1.0E-01 Ecology, 2007	5.5E+00 Ecology, 2007	5.5E+00 Ecology, 2007	1.20E-05 Ecology, 2006	3.30E+00 ODEQ, 2001	1.00E+01 ODEQ, 2001	2.00E-01 ODEQ, 2001	No Data
Mercury, Methyl	2.0E-04 ODEQ, 2001	No Data	4.0E-01 Ecology, 2007	4.0E-01 Ecology, 2007	No Data	5.0E-02 ODEQ, 2001	2.5E-01 ODEQ, 2001	No Data	No Data
Nickel	3.8E+01 USEPA, 2007	2.8E+02 USEPA, 2007	9.8E+02 Ecology, 2007	9.80E+02 Ecology, 2007	1.90E-02 Ecology, 2006[1]	5.62E+02 ODEQ, 2001	3.80E+01 ODEQ, 2001	1.80E+01 ODEQ, 2001	3.16E+02 ODEQ, 2001
Selenium	5.2E-01 USEPA, 2007	4.1E+00 USEPA, 2007	3.0E-01 Ecology, 2007	3.0E-01 Ecology, 2007	5.00E-03 Ecology, 2006	3.60E+00 ODEQ, 2001	1.50E+00 ODEQ, 2001	No Data	1.00E-01 ODEQ, 2001
Silver	5.6E+02 USEPA, 2006	5.0E+01 ODEQ, 2001	No Data	No Data	1.20E-04 ODEQ, 2001	No Data	No Data	4.50E+00 ODEQ, 2001	No Data
Thallium	1.0E+00 Ecology, 2007	1.0E+00 CCME 1999	No Data	1.0E+00 ODEQ, 2001	4.00E-02 ODEQ, 2001	No Data	6.00E-02 ODEQ, 2001	No Data	7.00E-01 ODEQ, 2001
Vanadium	2.0E+00 Ecology, 2007	No Data	4.7E+01 ODEQ, 2001	2.5E+01 ODEQ, 2001	2.00E-02 ODEQ, 2001	8.20E+01 ODEQ, 2001	1.60E+00 ODEQ, 2001	No Data	No Data
Zinc	1.6E+02 USEPA, 2007	1.2E+02 USEPA, 2007	3.6E+02 Ecology, 2007	3.60E+02 Ecology, 2007	1.26E-02 Ecology, 2006[1]	1.05E+02 ODEQ, 2001	1.23E+03 ODEQ, 2001	1.23E+02 ODEQ, 2001	3.00E+00 ODEQ, 2001

NOTES:
1. Hardness Dependant; Calculated @ Site-Specific Hardness (mg/L $CaCO_3$) = 8.23
No Data = No Data Available.
Use of surrogate chemical toxicity data indicated by chemical name adjacent to concentration.

Appendix A2. Data Summary and Initial Screening for all Surface Soil Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Soil Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/kg														
Metals																		
Aluminum	52	52	100%	5.29E+02	2.58E+04	1.05E+04	1.05E+04	NA	NA	5.00E+01	1.00E+05	2.46E+04	Yes	No	No	Yes	Yes	Yes
Antimony	90	85	94%	4.00E-01	1.07E+04	2.41E+03	2.41E+03	1.00E+00	4.00E+01	5.00E+00	4.09E+02	8.25E+00	Yes	Yes	No	Yes	Yes	Yes
Arsenic III	7	7	100%	3.00E+00	4.37E+02	2.76E+02	2.76E+02	NA	NA	7.00E+00	ND	0.00E+00	Yes	No	No	Yes	Yes	Yes
Arsenic V	7	7	100%	5.99E+01	8.54E+04	5.04E+04	5.04E+04	NA	NA	1.00E+01	ND	0.00E+00	Yes	No	No	Yes	Yes	Yes
Arsenic, total	93	93	100%	4.26E+01	9.21E+04	2.35E+04	2.35E+04	NA	NA	7.00E+00	1.59E+00	2.89E+02	Yes	No	No	Yes	Yes	Yes
Barium	52	52	100%	1.92E+01	1.17E+03	1.55E+02	1.55E+02	NA	NA	1.02E+02	6.66E+04	6.45E+01	Yes	No	No	Yes	Yes	Yes
Beryllium	61	15	25%	1.10E-01	2.93E+00	4.36E-01	4.36E-01	3.50E-02	1.00E+00	1.00E+01	1.94E+03	2.96E-01	Yes	No	No	Yes	Yes	Yes
Cadmium	92	76	83%	2.30E-01	1.14E+02	1.08E+01	1.08E+01	2.50E-02	5.00E+00	1.40E+01	4.51E+02	7.94E-01	Yes	No	No	Yes	Yes	Yes
Chromium, Total	90	84	93%	1.50E+00	2.17E+02	3.98E+01	3.98E+01	1.16E-01	2.50E+00	4.20E+01	4.48E+02	5.89E+01	Yes	No	No	Yes	Yes	Yes
Cobalt	52	41	79%	6.50E-01	2.81E+01	7.03E+00	7.03E+00	3.00E-01	3.00E+00	1.30E+01	1.92E+03	1.08E+01	Yes	No	No	Yes	Yes	Yes
Copper	93	93	100%	8.00E+00	4.24E+03	7.14E+02	7.14E+02	NA	NA	7.00E+01	4.09E+04	4.55E+01	Yes	No	No	Yes	Yes	Yes
Cyanide	3	0	0%	ND	ND	NA	0.00E+00	2.50E-01	2.50E-01	ND	1.23E+04	0.00E+00	No	No	No	No	No	No
Iron	55	55	100%	1.44E+04	2.72E+05	7.81E+04	7.81E+04	NA	NA	1.00E+01	1.00E+05	3.22E+04	Yes	No	No	Yes	Yes	Yes
Lead	93	93	100%	6.24E+00	8.92E+04	7.93E+03	7.93E+03	NA	NA	1.18E+02	8.00E+02	3.15E+01	Yes	No	No	Yes	Yes	Yes
Manganese	52	52	100%	1.66E+01	7.21E+03	8.18E+02	8.18E+02	NA	NA	2.20E+02	1.95E+04	9.02E+02	Yes	No	No	Yes	Yes	Yes
Mercury	90	90	100%	3.30E-02	3.63E+01	3.61E+00	3.61E+00	NA	NA	1.00E-01	3.07E+02	5.21E-01	Yes	No	No	Yes	Yes	Yes
Mercury, Methyl	3	3	100%	1.80E-02	4.00E-02	NA	4.00E-02	NA	NA	2.00E-04	6.16E+01	0.00E+00	Yes	No	No	Yes	Yes	Yes
Nickel	61	50	82%	6.04E-01	8.27E+01	2.11E+01	2.11E+01	2.35E-01	5.00E+01	3.80E+01	2.04E+04	2.85E+01	Yes	Yes	No	Yes	Yes	Yes
Selenium	90	50	56%	1.00E-01	1.74E+01	2.23E+00	2.23E+00	5.00E-02	5.00E+00	3.00E-01	5.11E+03	8.14E-01	Yes	Yes	No	Yes	Yes	Yes
Silver	90	88	98%	2.00E-01	4.15E+02	8.81E+01	8.81E+01	1.16E-01	1.50E+00	5.00E+01	5.11E+03	4.07E-01	Yes	No	No	Yes	Yes	Yes
Thallium	61	27	44%	1.20E-01	1.58E+01	5.20E+00	5.20E+00	1.00E-01	5.00E+00	1.00E+00	6.75E+01	0.00E+00	Yes	Yes	No	Yes	Yes	Yes
Vanadium	52	51	98%	9.20E-01	1.04E+02	3.52E+01	3.52E+01	2.50E+00	2.50E+00	2.00E+00	1.02E+03	7.11E+01	Yes	No	No	Yes	Yes	Yes
Zinc	93	93	100%	5.00E+00	1.85E+04	1.32E+03	1.32E+03	NA	NA	1.20E+02	1.00E+05	9.73E+01	Yes	No	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A3. Data Summary and Initial Screening for Human Health Risk Assessment Surface Soil Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Human Health Chemical of Interest?
				mg/kg												
Metals																
Aluminum	39	39	100%	5.29E+02	2.40E+04	9.68E+03	9.68E+03	NA	NA	1.00E+05	2.46E+04	Yes	No	No	No	No
Antimony	77	73	95%	4.00E-01	9.86E+03	1.97E+03	1.97E+03	1.00E+00	4.00E+01	4.09E+02	8.25E+00	Yes	Yes	No	Yes	Yes
Arsenic III	5	5	100%	3.00E+00	2.09E+02	2.09E+02	2.09E+02	NA	NA	No Data	0.00E+00	Yes	No	No	Yes	Yes
Arsenic V	5	5	100%	5.99E+01	3.59E+04	2.73E+04	2.73E+04	NA	NA	No Data	0.00E+00	Yes	No	No	Yes	Yes
Arsenic, total	80	80	100%	4.26E+01	9.21E+04	2.12E+04	2.12E+04	NA	NA	1.59E+00	2.89E+02	Yes	No	No	Yes	Yes
Barium	39	39	100%	1.92E+01	1.17E+03	1.94E+02	1.94E+02	NA	NA	6.66E+04	6.45E+01	Yes	No	No	Yes	Yes
Beryllium	48	13	27%	1.10E-01	2.93E+00	4.99E-01	4.99E-01	3.50E-02	1.00E+00	1.94E+03	2.96E-01	Yes	No	No	Yes	Yes
Cadmium	79	64	81%	2.30E-01	5.50E+01	6.37E+00	6.37E+00	2.50E-02	5.00E+00	4.51E+02	7.94E-01	Yes	No	No	Yes	Yes
Chromium, Total	77	71	92%	1.50E+00	2.17E+02	3.95E+01	3.95E+01	1.16E-01	2.50E+00	4.48E+02	5.89E+01	Yes	No	No	Yes	Yes
Cobalt	39	32	82%	6.50E-01	2.81E+01	7.19E+00	7.19E+00	3.00E-01	3.00E+00	1.92E+03	1.08E+01	Yes	No	No	Yes	Yes
Copper	80	80	100%	8.00E+00	2.88E+03	6.24E+02	6.24E+02	NA	NA	4.09E+04	4.55E+01	Yes	No	No	Yes	Yes
Cyanide	3	0	0%	ND	ND	NA	0.00E+00	2.50E-01	2.50E-01	1.23E+04	0.00E+00	No	No	No	No	No
Iron	42	42	100%	1.44E+04	2.72E+05	8.25E+04	8.25E+04	NA	NA	1.00E+05	3.22E+04	Yes	No	No	Yes	Yes
Lead	80	80	100%	6.24E+00	8.92E+04	7.29E+03	7.29E+03	NA	NA	8.00E+02	3.15E+01	Yes	No	No	Yes	Yes
Manganese	39	39	100%	1.66E+01	4.82E+03	6.85E+02	6.85E+02	NA	NA	1.95E+04	9.02E+02	Yes	No	No	Yes	Yes
Mercury	77	77	100%	3.30E-02	3.63E+01	3.30E+00	3.30E+00	NA	NA	3.07E+02	5.21E-01	Yes	No	No	Yes	Yes
Mercury, Methyl	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	6.16E+01	0.00E+00	No	No	No	No	No
Nickel	48	39	81%	6.04E-01	8.27E+01	2.12E+01	2.12E+01	2.35E-01	5.00E+01	2.04E+04	2.85E+01	Yes	Yes	No	Yes	Yes
Selenium	77	40	52%	1.00E-01	1.74E+01	2.12E+00	2.12E+00	5.00E-02	5.00E+00	5.11E+03	8.14E-01	Yes	Yes	No	Yes	Yes
Silver	77	75	97%	2.00E-01	4.15E+02	8.30E+01	8.30E+01	1.16E-01	1.50E+00	5.11E+03	4.07E-01	Yes	No	No	Yes	Yes
Thallium	48	21	44%	1.20E-01	1.58E+01	3.82E+00	3.82E+00	1.00E-01	5.00E+00	6.75E+01	0.00E+00	Yes	Yes	No	Yes	Yes
Vanadium	39	39	100%	9.20E-01	1.04E+02	4.05E+01	4.05E+01	NA	NA	1.02E+03	7.11E+01	Yes	No	No	Yes	Yes
Zinc	80	80	100%	5.00E+00	3.55E+03	7.14E+02	7.14E+02	NA	NA	1.00E+05	9.73E+01	Yes	No	No	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A4. Data Summary and Initial Screening for all Human Health Risk Assessment Subsurface Soil
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Soil Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Human Health Chemical of Interest?
				mg/kg												
Metals																
Aluminum	16	16	100%	6.60E+02	2.58E+04	2.67E+01	2.67E+01	NA	NA	5.00E+01	1.00E+05	2.46E+04	Yes	No	Yes	Yes
Antimony	16	15	94%	2.00E+01	1.07E+04	1.06E+01	1.06E+01	1.00E+00	1.00E+00	5.00E+00	4.09E+02	8.25E+00	Yes	No	Yes	Yes
Arsenic III	3	3	100%	3.80E+01	4.37E+02	NA	4.37E+02	NA	NA	7.00E+00	No Data	0.00E+00	Yes	No	Yes	Yes
Arsenic V	3	3	100%	1.09E+04	8.54E+04	NA	8.54E+04	NA	NA	1.00E+01	No Data	0.00E+00	Yes	No	Yes	Yes
Arsenic, total	16	16	100%	1.37E+02	8.58E+04	3.90E-01	3.90E-01	NA	NA	7.00E+00	1.59E+00	2.89E+02	Yes	No	Yes	Yes
Barium	16	16	100%	2.25E+01	2.39E+02	8.73E+01	8.73E+01	NA	NA	1.02E+02	6.66E+04	6.45E+01	Yes	No	Yes	Yes
Beryllium	16	2	13%	3.20E-01	6.00E-01	6.41E-01	6.00E-01	1.00E-01	1.00E+00	1.00E+01	1.94E+03	2.96E-01	Yes	No	Yes	Yes
Cadmium	16	15	94%	1.62E+00	1.14E+02	4.17E+00	4.17E+00	1.00E-01	1.00E-01	1.40E+01	4.51E+02	7.94E-01	Yes	No	Yes	Yes
Chromium, Total	16	16	100%	2.02E+01	8.15E+01	9.21E+00	9.21E+00	NA	NA	4.20E+01	4.48E+02	5.89E+01	Yes	No	Yes	Yes
Cobalt	16	11	69%	1.20E+00	2.10E+01	1.84E+00	1.84E+00	3.00E-01	3.00E+00	1.30E+01	1.92E+03	1.08E+01	Yes	No	Yes	Yes
Copper	16	16	100%	2.99E+01	4.24E+03	9.21E+00	9.21E+00	NA	NA	7.00E+01	4.09E+04	4.55E+01	Yes	No	Yes	Yes
Iron	16	16	100%	2.10E+04	1.42E+05	6.09E+02	6.09E+02	NA	NA	1.00E+01	1.00E+05	3.22E+04	Yes	No	Yes	Yes
Lead	16	16	100%	3.66E+01	2.08E+04	2.45E-02	2.45E-02	NA	NA	1.18E+02	8.00E+02	3.15E+01	Yes	No	Yes	Yes
Manganese	16	16	100%	1.80E+01	7.21E+03	2.45E-02	2.45E-02	NA	NA	2.20E+02	1.95E+04	9.02E+02	Yes	No	Yes	Yes
Mercury	16	16	100%	4.80E-02	7.75E+00	2.45E-02	2.45E-02	NA	NA	1.00E-01	3.07E+02	5.21E-01	Yes	No	Yes	Yes
Mercury, Methyl	3	3	100%	1.80E-02	4.00E-02	NA	4.00E-02	NA	NA	2.00E-04	6.16E+01	0.00E+00	Yes	No	Yes	Yes
Nickel	16	12	75%	2.70E+00	4.56E+01	4.17E-02	4.17E-02	1.00E+01	5.00E+01	3.80E+01	2.04E+04	2.85E+01	Yes	No	Yes	Yes
Selenium	16	11	69%	6.10E-01	6.77E+00	7.72E-02	7.72E-02	3.00E-01	3.00E+00	3.00E-01	5.11E+03	8.14E-01	Yes	No	Yes	Yes
Silver	16	16	100%	5.60E-01	2.94E+02	3.56E-02	3.56E-02	NA	NA	5.00E+01	5.11E+03	4.07E-01	Yes	No	Yes	Yes
Thallium	16	7	44%	3.40E+00	4.90E+00	3.57E-02	3.57E-02	7.50E-01	5.00E+00	1.00E+00	6.75E+01	0.00E+00	Yes	No	Yes	Yes
Vanadium	16	14	88%	2.40E+00	7.08E+01	3.57E-02	3.57E-02	2.50E+00	2.50E+00	2.00E+00	1.02E+03	7.11E+01	Yes	No	No	No
Zinc	16	16	100%	5.88E+01	1.85E+04	3.57E-02	3.57E-02	NA	NA	1.20E+02	1.00E+05	9.73E+01	Yes	No	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A5. Data Summary and Initial Screening for all Surface Water Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Surface Water Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/L														
Metals																		
Aluminum	9	1	11%	1.16E+00	1.16E+00	4.87E-01	4.87E-01	1.50E-02	1.50E-02	8.70E-02	3.65E+04	0.0E+00	Yes	No	No	Yes	Yes	Yes
Antimony	49	41	84%	6.00E-04	3.12E-02	8.58E-03	8.58E-03	2.00E-04	1.00E-02	1.00E+00	1.46E+01	3.44E-03	Yes	No	No	Yes	Yes	Yes
Arsenic III	5	5	100%	1.25E-04	1.70E-03	1.33E-03	1.33E-03	NA	NA	1.50E-01	No Data	4.95E-05	Yes	No	No	Yes	Yes	NA
Arsenic V	5	5	100%	4.38E-03	1.36E+00	7.92E+00	1.36E+00	NA	NA	1.50E-01	No Data	9.36E-04	Yes	No	No	Yes	Yes	NA
Arsenic, Total	56	55	98%	1.60E-03	6.35E+00	6.83E-01	6.83E-01	1.85E-04	1.85E-04	1.90E-01	4.48E-02	3.01E-03	Yes	No	No	Yes	Yes	Yes
Barium	9	8	89%	2.50E-03	8.50E-03	6.06E-03	6.06E-03	1.00E-03	1.00E-03	4.00E-03	2.55E+03	6.63E-03	Yes	No	No	Yes	Yes	Yes
Beryllium	17	0	0%	ND	ND	NA	0.00E+00	5.00E-05	1.00E-03	5.30E-03	7.30E+01	0.00E+00	No	No	No	No	No	No
Cadmium	51	14	27%	1.00E-04	4.00E-02	4.95E-03	4.95E-03	1.85E-05	2.50E-03	1.62E-04	1.82E+01	0.00E+00	Yes	Yes	No	Yes	Yes	Yes
Chromium, Total	42	0	0%	ND	ND	NA	0.00E+00	2.50E-04	5.00E-03	2.30E-02	No Data	0.00E+00	No	No	No	No	No	No
Cobalt	9	1	11%	1.49E-02	1.49E-02	7.91E-03	7.91E-03	3.00E-03	3.00E-03	2.30E-02	7.30E+02	0.00E+00	Yes	No	No	Yes	Yes	Yes
Copper	56	25	45%	2.60E-04	2.64E+00	2.46E-01	2.46E-01	2.50E-04	5.00E-02	1.34E-03	1.46E+03	2.38E-03	Yes	Yes	No	Yes	Yes	Yes
Iron	25	16	64%	3.00E-02	4.80E+01	1.02E+01	1.02E+01	3.00E-02	5.00E-01	1.00E+00	1.09E+04	0.00E+00	Yes	No	No	Yes	Yes	Yes
Lead	56	37	66%	2.00E-05	5.62E-01	4.70E-02	4.70E-02	1.00E-05	5.00E-02	1.53E-04	No Data	3.65E-04	Yes	Yes	No	Yes	Yes	Yes
Manganese	20	11	55%	5.00E-03	4.23E+00	9.73E-01	9.73E-01	2.00E-03	2.50E-03	1.20E-01	8.76E+02	0.00E+00	Yes	No	No	Yes	Yes	Yes
Mercury	44	34	77%	4.20E-07	8.20E-04	8.37E-05	8.37E-05	2.50E-05	1.00E-04	1.20E-05	1.09E+01	6.92E-06	Yes	Yes	No	Yes	Yes	Yes
Mercury, methyl	1	0	0%	ND	ND	NA	0.00E+00	1.00E-08	1.00E-08	5.00E-02	3.65E+00	0.00E+00	No	No	No	No	No	No
Nickel	24	9	38%	2.80E-04	1.40E-03	2.51E-03	1.40E-03	2.50E-04	5.00E-03	1.90E-02	7.30E+02	4.03E-03	Yes	No	No	No	No	No
Selenium	34	3	9%	1.00E-04	3.00E-04	5.72E-04	3.00E-04	5.00E-05	1.50E-03	5.00E-03	1.82E+02	0.00E+00	Yes	No	No	Yes	Yes	Yes
Silver	42	6	14%	5.00E-05	3.82E-03	8.65E-04	8.65E-04	2.50E-05	2.50E-03	1.20E-04	1.82E+02	0.00E+00	Yes	Yes	No	Yes	Yes	Yes
Thallium	17	1	6%	3.60E-04	3.60E-04	5.13E-04	3.60E-04	5.00E-05	1.00E-03	4.00E-02	2.41E+00	0.00E+00	Yes	No	No	Yes	Yes	Yes
Vanadium	9	0	0%	ND	ND	NA	0.00E+00	2.50E-03	2.50E-03	2.00E-02	3.65E+01	0.00E+00	No	No	No	No	No	No
Zinc	56	25	45%	3.10E-03	6.59E+00	1.05E+00	1.05E+00	2.50E-03	5.00E-02	1.26E-02	1.09E+04	5.24E-03	Yes	Yes	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A6. Data Summary and Initial Screening for all Pore Water Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Surface Water Ecological Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?
				mg/L											
Metals															
Aluminum	6	1	17%	4.50E-02	4.50E-02	3.01E-02	3.01E-02	1.50E-02	1.50E-02	8.70E-02	0.00E+00	Yes	No	Yes	Yes
Antimony	13	7	54%	2.60E-03	6.30E-03	5.91E-03	5.91E-03	2.50E-03	1.00E-02	1.00E+00	0.00E+00	Yes	No	Yes	Yes
Arsenic III	5	3	60%	1.60E-05	1.38E-04	2.00E-04	1.38E-04	4.00E-06	4.00E-06	1.50E-01	0.00E+00	Yes	No	Yes	Yes
Arsenic V	5	3	60%	3.78E-03	1.03E-02	9.33E-03	9.33E-03	5.30E-03	7.90E-03	1.50E-01	0.00E+00	Yes	No	Yes	Yes
Arsenic, Total	13	13	100%	3.80E-03	2.82E+00	8.13E-01	8.13E-01	NA	NA	1.90E-01	0.00E+00	Yes	No	Yes	Yes
Barium	6	5	83%	3.30E-03	9.60E-03	7.08E-03	7.08E-03	1.00E-03	1.00E-03	4.00E-03	1.82E-02	Yes	No	No	No
Beryllium	6	0	0%	ND	ND	NA	0.00E+00	1.00E-03	1.00E-03	5.30E-03	0.00E+00	No	No	No	No
Cadmium	13	0	0%	ND	ND	NA	0.00E+00	2.50E-05	1.00E-03	1.62E-04	0.00E+00	No	Yes	No	Yes
Chromium VI	1	1	100%	2.00E-02	2.00E-02	NA	2.00E-02	NA	NA	1.00E-02	1.00E-02	Yes	No	Yes	Yes
Chromium, Total	13	0	0%	ND	ND	NA	0.00E+00	3.00E-03	5.00E-03	2.30E-02	0.00E+00	No	No	No	No
Cobalt	6	0	0%	ND	ND	NA	0.00E+00	3.00E-03	3.00E-03	2.30E-02	0.00E+00	No	No	No	No
Copper	13	0	0%	ND	ND	NA	0.00E+00	5.00E-05	5.00E-03	1.34E-03	0.00E+00	No	Yes	No	Yes
Iron	6	0	0%	ND	ND	NA	0.00E+00	3.00E-02	3.00E-02	1.00E+00	0.00E+00	No	No	No	No
Lead	13	1	8%	2.00E-04	2.00E-04	1.08E-03	2.00E-04	5.00E-05	1.50E-03	1.53E-04	0.00E+00	Yes	Yes	Yes	Yes
Manganese	6	0	0%	ND	ND	NA	0.00E+00	2.00E-03	2.00E-03	1.20E-01	3.27E-03	No	No	No	No
Mercury	13	13	100%	3.20E-07	1.40E-06	1.02E-06	1.02E-06	NA	NA	1.20E-05	1.21E-06	Yes	No	Yes	Yes
Mercury, methyl	1	0	0%	ND	ND	NA	0.00E+00	1.00E-08	1.00E-08	5.00E-02	0.00E+00	No	No	No	No
Nickel	6	0	0%	ND	ND	NA	0.00E+00	2.50E-03	5.00E-03	1.90E-02	0.00E+00	No	No	No	No
Selenium	13	0	0%	ND	ND	NA	0.00E+00	5.00E-05	1.50E-03	5.00E-03	0.00E+00	No	No	No	No
Silver	13	0	0%	ND	ND	NA	0.00E+00	2.50E-05	2.50E-03	1.20E-04	0.00E+00	No	Yes	No	Yes
Thallium	6	0	0%	ND	ND	NA	0.00E+00	1.00E-03	1.00E-03	4.00E-02	0.00E+00	No	No	No	No
Vanadium	6	0	0%	ND	ND	NA	0.00E+00	2.50E-03	2.50E-03	2.00E-02	0.00E+00	No	No	No	No
Zinc	13	1	8%	1.00E-02	1.00E-02	6.07E-03	6.07E-03	5.00E-03	5.00E-03	1.26E-02	9.33E-03	Yes	No	Yes	Yes

NOTES:
Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A7. Data Summary and Initial Screenin for all Sediment Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Sediment Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/kg														
Metals																		
Aluminum	7	7	100%	9.96E+03	1.71E+04	1.59E+04	1.59E+04	NA	NA	No Data	1.00E+05	1.25E+04	Yes	No	No	Yes	Yes	Yes
Antimony	37	37	100%	8.50E-03	5.10E+01	1.83E+01	1.83E+01	NA	NA	3.00E+00	4.09E+02	6.73E+00	Yes	No	No	Yes	Yes	Yes
Arsenic III	7	7	100%	8.20E-04	4.27E-03	3.19E-03	3.19E-03	NA	NA	4.00E+00	No Data	4.42E-04	Yes	No	No	Yes	Yes	Yes
Arsenic V	7	7	100%	2.50E+02	5.44E+02	4.39E+02	4.39E+02	NA	NA	4.00E+00	No Data	9.58E+01	Yes	No	No	Yes	Yes	Yes
Arsenic, total	37	37	100%	2.81E-01	1.09E+03	3.93E+02	3.93E+02	NA	NA	4.00E+00	1.59E+00	1.34E+02	Yes	No	No	Yes	Yes	Yes
Barium	17	17	100%	5.28E+01	1.06E+02	8.96E+01	8.96E+01	NA	NA	No Data	6.66E+04	8.15E+01	Yes	No	No	Yes	Yes	Yes
Beryllium	8	6	75%	1.70E-01	2.30E-01	2.07E-01	2.07E-01	1.00E-01	1.00E-01	1.22E+02	1.94E+03	1.45E-01	Yes	No	No	Yes	Yes	Yes
Cadmium	37	37	100%	6.10E-01	3.90E+00	1.49E+00	1.49E+00	NA	NA	3.00E-03	4.51E+02	1.15E+00	Yes	No	No	Yes	Yes	Yes
Chromium, Total	37	37	100%	1.20E+01	6.50E+01	4.53E+01	4.53E+01	NA	NA	3.70E+01	4.48E+02	4.77E+01	Yes	No	No	Yes	Yes	Yes
Cobalt	7	7	100%	9.56E+00	1.25E+01	1.15E+01	1.15E+01	NA	NA	No Data	1.92E+03	9.54E+00	Yes	No	No	Yes	Yes	Yes
Copper	37	37	100%	2.60E+01	2.07E+02	9.11E+01	9.11E+01	NA	NA	1.00E+01	4.09E+04	3.27E+01	Yes	No	No	Yes	Yes	Yes
Iron	17	17	100%	2.45E+04	3.14E+04	2.97E+04	2.97E+04	NA	NA	4.00E+04	1.00E+05	2.59E+04	Yes	No	No	Yes	Yes	Yes
Lead	37	37	100%	2.95E+01	2.78E+02	1.09E+02	1.09E+02	NA	NA	3.50E+01	8.00E+02	6.47E+01	Yes	No	No	Yes	Yes	Yes
Manganese	17	17	100%	6.16E+02	1.51E+03	9.92E+02	9.92E+02	NA	NA	1.10E+03	1.95E+04	1.20E+03	Yes	No	No	Yes	Yes	Yes
Mercury	20	12	60%	9.10E-02	4.60E+00	9.40E-01	9.40E-01	2.50E-02	2.50E-02	2.00E-01	3.07E+02	4.41E-01	Yes	No	No	Yes	Yes	Yes
Mercury, Methyl	3	1	33%	1.70E-05	1.70E-05	NA	1.70E-05	6.00E-06	6.00E-06	No Data	6.16E+01	0.00E+00	Yes	No	No	Yes	Yes	Yes
Nickel	8	8	100%	1.02E+01	9.65E+01	5.23E+01	5.23E+01	NA	NA	1.80E+01	2.04E+04	1.25E+01	Yes	No	No	Yes	Yes	Yes
Selenium	27	24	89%	8.00E-02	4.60E-01	2.79E-01	2.79E-01	1.50E-01	2.50E-01	1.00E-01	5.11E+03	5.44E-01	Yes	No	No	No	No	No
Silver	27	20	74%	2.10E-01	6.94E+00	1.72E+00	1.72E+00	2.50E-01	2.50E-01	4.50E+00	5.11E+03	1.91E-01	Yes	No	No	Yes	Yes	Yes
Thallium	8	3	38%	1.70E-01	2.80E-01	2.00E-01	2.00E-01	1.00E-01	1.00E-01	7.00E-01	6.75E+01	1.51E-01	Yes	No	No	Yes	Yes	Yes
Vanadium	7	7	100%	4.77E+01	6.62E+01	6.09E+01	6.09E+01	NA	NA	No Data	1.02E+03	4.91E+01	Yes	No	No	Yes	Yes	Yes
Zinc	37	37	100%	1.15E+02	8.06E+02	2.22E+02	2.22E+02	NA	NA	3.00E+00	1.00E+05	1.22E+02	Yes	No	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A8. Data Summary and Initial Screening for all Human Health Risk Assessment Soil Samples - Near Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Human Health Chemical of Interest?
				mg/kg											
Metals															
Aluminum	50	50	100%	5.29E+02	2.58E+04	8.84E+03	8.84E+03	NA	NA	1.00E+05	2.46E+04	Yes	No	Yes	Yes
Antimony	62	58	94%	4.00E-01	1.07E+04	2.83E+03	2.83E+03	1.00E+00	2.00E+01	4.09E+02	8.25E+00	Yes	No	Yes	Yes
Arsenic III	8	8	100%	3.00E+00	4.37E+02	2.57E+02	2.57E+02	NA	NA	No Data	0.00E+00	Yes	No	Yes	Yes
Arsenic V	8	8	100%	5.99E+01	8.54E+04	4.69E+04	4.69E+04	NA	NA	No Data	0.00E+00	Yes	No	Yes	Yes
Arsenic, total	62	62	100%	6.29E+01	9.21E+04	2.72E+04	2.72E+04	NA	NA	1.59E+00	2.89E+02	Yes	No	Yes	Yes
Barium	50	50	100%	1.92E+01	1.17E+03	1.67E+02	1.67E+02	NA	NA	6.66E+04	6.45E+01	Yes	No	Yes	Yes
Beryllium	56	12	21%	1.10E-01	2.93E+00	5.33E-01	5.33E-01	3.50E-02	1.00E+00	1.94E+03	2.96E-01	Yes	No	Yes	Yes
Cadmium	62	56	90%	2.30E-01	1.14E+02	1.67E+01	1.67E+01	2.50E-02	1.00E+00	4.51E+02	7.94E-01	Yes	No	Yes	Yes
Chromium, Total	62	60	97%	1.50E+00	1.42E+02	4.36E+01	4.36E+01	1.20E-01	5.00E-01	4.48E+02	5.89E+01	Yes	No	Yes	Yes
Cobalt	50	38	76%	6.50E-01	2.81E+01	6.88E+00	6.88E+00	3.00E-01	3.00E+00	1.92E+03	1.08E+01	Yes	No	Yes	Yes
Copper	62	62	100%	8.00E+00	4.24E+03	8.78E+02	8.78E+02	NA	NA	4.09E+04	4.55E+01	Yes	No	Yes	Yes
Cyanide	6	3	50%	4.70E+04	8.54E+04	6.04E+04	6.04E+04	2.50E-01	2.50E-01	1.23E+04	0.00E+00	Yes	No	Yes	Yes
Iron	50	50	100%	2.22E+03	1.49E+05	6.46E+04	6.46E+04	NA	NA	1.00E+05	3.22E+04	Yes	No	Yes	Yes
Lead	62	61	98%	6.24E+00	2.25E+04	8.32E+03	8.32E+03	3.00E+01	3.00E+01	8.00E+02	3.15E+01	Yes	No	Yes	Yes
Manganese	50	50	100%	2.67E-01	7.21E+03	6.30E+00	6.30E+00	NA	NA	1.95E+04	9.02E+02	Yes	No	Yes	Yes
Mercury	59	59	100%	3.30E-02	3.63E+01	4.23E+00	4.23E+00	NA	NA	3.07E+02	5.21E-01	Yes	No	Yes	Yes
Mercury, Methyl	6	4	67%	1.80E-02	1.10E+01	2.18E+01	1.10E+01	1.00E+01	2.50E+01	6.16E+01	0.00E+00	Yes	No	Yes	Yes
Nickel	56	46	82%	6.04E-01	3.69E+03	3.71E+02	3.71E+02	2.35E-01	5.00E+01	2.04E+04	2.85E+01	Yes	No	Yes	Yes
Selenium	62	41	66%	1.00E-01	1.33E+02	9.08E+00	9.08E+00	2.50E-01	3.00E+00	5.11E+03	8.14E-01	Yes	No	Yes	Yes
Silver	62	59	95%	2.00E-01	4.15E+02	1.21E+02	1.21E+02	2.50E+02	2.50E+02	5.11E+03	4.07E-01	Yes	No	Yes	Yes
Thallium	56	22	39%	1.20E-01	2.76E+01	5.43E+00	5.43E+00	1.00E-01	5.00E+00	6.75E+01	0.00E+00	Yes	No	Yes	Yes
Vanadium	50	49	98%	9.20E-01	1.74E+04	1.77E+02	1.77E+02	2.50E+00	2.50E+00	1.02E+03	7.11E+01	Yes	No	Yes	Yes
Zinc	59	59	100%	5.00E+00	1.85E+04	0.00E+00	0.00E+00	NA	NA	1.00E+05	9.73E+01	Yes	No	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A9. Data Summary and Initial Screening for all Human Health Risk Assessment Soil Samples - Remote from Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Human Health Chemical of Interest?
				mg/kg											
Metals															
Aluminum	5.00E+00	5.00E+00	100%	1.27E+03	7.37E+03	5.71E+03	5.71E+03	NA	NA	1.00E+05	2.46E+04	Yes	No	No	No
Antimony	3.10E+01	3.00E+01	97%	5.70E-01	8.80E+03	3.89E+03	3.89E+03	4.00E+01	4.00E+01	4.09E+02	8.25E+00	Yes	No	Yes	Yes
Arsenic III	0.00E+00	0.00E+00	0%	ND	ND	NA	0.00E+00	NA	NA	No Data	0.00E+00	No	No	No	No
Arsenic V	0.00E+00	0.00E+00	0%	ND	ND	NA	0.00E+00	NA	NA	No Data	0.00E+00	No	No	No	No
Arsenic, total	3.40E+01	3.40E+01	100%	4.26E+01	7.34E+04	1.96E+04	1.96E+04	NA	NA	1.59E+00	2.89E+02	Yes	No	Yes	Yes
Barium	5.00E+00	5.00E+00	100%	1.94E+01	8.10E+01	7.45E+01	7.45E+01	NA	NA	6.66E+04	6.45E+01	Yes	No	Yes	Yes
Beryllium	8.00E+00	3.00E+00	38%	1.70E-01	2.50E-01	1.74E-01	1.74E-01	3.50E-02	1.00E-01	1.94E+03	2.96E-01	Yes	No	No	No
Cadmium	3.30E+01	2.30E+01	70%	3.30E-01	5.50E+01	8.83E+00	8.83E+00	2.50E-02	5.00E+00	4.51E+02	7.94E-01	Yes	No	Yes	Yes
Chromium, Total	3.10E+01	2.70E+01	87%	3.00E+00	2.17E+02	3.59E+01	3.59E+01	1.16E-01	2.50E+00	4.48E+02	5.89E+01	Yes	No	Yes	Yes
Cobalt	5.00E+00	5.00E+00	100%	1.51E+00	2.12E+01	2.73E+01	2.12E+01	NA	NA	1.92E+03	1.08E+01	Yes	No	Yes	Yes
Copper	3.40E+01	3.40E+01	100%	4.80E+01	1.66E+03	5.51E+02	5.51E+02	NA	NA	4.09E+04	4.55E+01	Yes	No	Yes	Yes
Cyanide	0.00E+00	0.00E+00	0%	ND	ND	NA	0.00E+00	NA	NA	1.23E+04	0.00E+00	No	No	No	No
Iron	8.00E+00	8.00E+00	100%	4.55E+04	2.72E+05	2.43E+05	2.43E+05	NA	NA	1.00E+05	3.22E+04	Yes	No	Yes	Yes
Lead	3.40E+01	3.40E+01	100%	1.48E+01	8.92E+04	9.28E+03	9.28E+03	NA	NA	8.00E+02	3.15E+01	Yes	No	Yes	Yes
Manganese	5.00E+00	5.00E+00	100%	5.59E+01	4.82E+03	2.14E+04	4.82E+03	NA	NA	1.95E+04	9.02E+02	Yes	No	Yes	Yes
Mercury	3.10E+01	3.10E+01	100%	5.00E-02	8.61E+00	2.03E+00	2.03E+00	NA	NA	3.07E+02	5.21E-01	Yes	No	Yes	Yes
Mercury, Methyl	0.00E+00	0.00E+00	0%	ND	ND	NA	0.00E+00	NA	NA	6.16E+01	0.00E+00	No	No	No	No
Nickel	8.00E+00	7.00E+00	88%	7.90E+00	8.27E+01	4.38E+01	4.38E+01	2.50E+00	2.50E+00	2.04E+04	2.85E+01	Yes	No	Yes	Yes
Selenium	3.10E+01	1.20E+01	39%	1.00E-01	1.74E+01	3.55E+00	3.55E+00	5.00E-02	5.00E+00	5.11E+03	8.14E-01	Yes	No	Yes	Yes
Silver	3.10E+01	2.90E+01	94%	2.00E-01	3.07E+02	7.79E+00	7.79E+00	1.16E-01	1.50E+00	5.11E+03	4.07E-01	Yes	No	Yes	Yes
Thallium	8.00E+00	7.00E+00	88%	2.20E-01	5.80E+00	3.97E+00	3.97E+00	7.50E-01	7.50E-01	6.75E+01	0.00E+00	Yes	No	Yes	Yes
Vanadium	5.00E+00	5.00E+00	100%	5.94E+00	7.39E+01	5.37E+01	5.37E+01	NA	NA	1.02E+03	7.11E+01	Yes	No	Yes	Yes
Zinc	3.40E+01	3.40E+01	100%	2.10E+01	3.55E+03	9.95E+02	9.95E+02	NA	NA	1.00E+05	9.73E+01	Yes	No	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A10. Data Summary and Initial Screening for Human Health Risk Assessment Surface Soil Samples - Near Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Human Health Chemical of Interest?
				mg/kg												
Metals																
Aluminum	34	34	100%	5.29E+02	2.40E+04	1.05E+04	1.05E+04	NA	NA	1.00E+05	2.46E+04	Yes	No	No	No	No
Antimony	46	43	93%	4.00E-01	9.86E+03	2.46E+03	2.46E+03	1.00E+00	2.00E+01	4.09E+02	8.25E+00	Yes	Yes	No	Yes	Yes
Arsenic III	5	5	100%	3.00E+00	2.09E+02	2.09E+02	2.09E+02	NA	NA	No Data	0.00E+00	Yes	No	No	Yes	Yes
Arsenic V	5	5	100%	5.99E+01	3.59E+04	2.73E+04	2.73E+04	NA	NA	No Data	0.00E+00	Yes	No	No	Yes	Yes
Arsenic, total	46	46	100%	6.29E+01	9.21E+04	2.54E+04	2.54E+04	NA	NA	1.59E+00	2.89E+02	Yes	No	No	Yes	Yes
Barium	34	34	100%	1.92E+01	1.17E+03	2.16E+02	2.16E+02	NA	NA	6.66E+04	6.45E+01	Yes	No	No	Yes	Yes
Beryllium	40	10	25%	1.10E-01	2.93E+00	5.70E-01	5.70E-01	3.50E-02	1.00E+00	1.94E+03	2.96E-01	Yes	No	No	Yes	Yes
Cadmium	46	41	89%	2.30E-01	1.63E+01	5.56E+00	5.56E+00	2.50E-02	1.00E+00	4.51E+02	7.94E-01	Yes	No	No	Yes	Yes
Chromium, Total	46	44	96%	1.50E+00	1.42E+02	4.50E+01	4.50E+01	1.20E-01	5.00E-01	4.48E+02	5.89E+01	Yes	No	No	Yes	Yes
Cobalt	34	27	79%	6.50E-01	2.81E+01	7.04E+00	7.04E+00	3.00E-01	3.00E+00	1.92E+03	1.08E+01	Yes	No	No	Yes	Yes
Copper	46	46	100%	8.00E+00	2.88E+03	7.70E+02	7.70E+02	NA	NA	4.09E+04	4.55E+01	Yes	No	No	Yes	Yes
Cyanide	3	0	0%	ND	ND	NA	0.00E+00	2.50E-01	2.50E-01	1.23E+04	0.00E+00	No	No	No	No	No
Iron	34	34	100%	1.44E+04	1.49E+05	6.46E+04	6.46E+04	NA	NA	1.00E+05	3.22E+04	Yes	No	No	Yes	Yes
Lead	46	46	100%	6.24E+00	2.25E+04	7.90E+03	7.90E+03	NA	NA	8.00E+02	3.15E+01	Yes	No	No	Yes	Yes
Manganese	34	34	100%	1.66E+01	1.81E+03	4.42E+02	4.42E+02	NA	NA	1.95E+04	9.02E+02	Yes	No	No	Yes	Yes
Mercury	46	46	100%	3.30E-02	3.63E+01	6.47E+00	6.47E+00	NA	NA	3.07E+02	5.21E-01	Yes	No	No	Yes	Yes
Mercury, Methyl	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	6.16E+01	0.00E+00	No	No	No	No	No
Nickel	40	32	80%	6.04E-01	5.00E+01	1.86E+01	1.86E+01	2.35E-01	5.00E+01	2.04E+04	2.85E+01	Yes	Yes	No	Yes	Yes
Selenium	46	28	61%	1.00E-01	4.40E+00	1.77E+00	1.77E+00	2.50E-01	3.00E+00	5.11E+03	8.14E-01	Yes	Yes	No	Yes	Yes
Silver	46	46	100%	2.00E-01	4.15E+02	1.05E+02	1.05E+02	NA	NA	5.11E+03	4.07E-01	Yes	No	No	Yes	Yes
Thallium	40	14	35%	1.20E-01	1.58E+01	4.05E+00	4.05E+00	1.00E-01	5.00E+00	6.75E+01	0.00E+00	Yes	Yes	No	Yes	Yes
Vanadium	34	34	100%	9.20E-01	1.04E+02	4.20E+01	4.20E+01	NA	NA	1.02E+03	7.11E+01	Yes	No	No	Yes	Yes
Zinc	46	46	100%	5.00E+00	1.85E+03	6.04E+02	6.04E+02	NA	NA	1.00E+05	9.73E+01	Yes	No	No	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A11. Data Summary and Initial Screening for Human Health Risk Assessment Surface Soil Samples - Remote from Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Human Health Chemical of Interest?
				mg/kg												
Metals																
Aluminum	5	5	100%	1.27E+03	7.37E+03	5.71E+03	5.71E+03	NA	NA	1.00E+05	2.46E+04	Yes	No	No	No	No
Antimony	31	30	97%	5.70E-01	8.80E+03	3.89E+03	3.89E+03	4.00E+01	4.00E+01	4.09E+02	8.25E+00	Yes	Yes	No	Yes	Yes
Arsenic III	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	No Data	0.00E+00	No	No	No	No	No
Arsenic V	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	No Data	0.00E+00	No	No	No	No	No
Arsenic, total	34	34	100%	4.26E+01	7.34E+04	1.96E+04	1.96E+04	NA	NA	1.59E+00	2.89E+02	Yes	No	No	Yes	Yes
Barium	5	5	100%	1.94E+01	8.10E+01	7.45E+01	7.45E+01	NA	NA	6.66E+04	6.45E+01	Yes	No	No	Yes	Yes
Beryllium	8	3	38%	1.70E-01	2.50E-01	1.74E-01	1.74E-01	3.50E-02	1.00E-01	1.94E+03	2.96E-01	Yes	No	No	No	No
Cadmium	33	23	70%	3.30E-01	5.50E+01	8.83E+00	8.83E+00	2.50E-02	5.00E+00	4.51E+02	7.94E-01	Yes	No	No	Yes	Yes
Chromium, Total	31	27	87%	3.00E+00	2.17E+02	3.59E+01	3.59E+01	1.16E-01	2.50E+00	4.48E+02	5.89E+01	Yes	No	No	Yes	Yes
Cobalt	5	5	100%	1.51E+00	2.12E+01	2.73E+01	2.12E+01	NA	NA	1.92E+03	1.08E+01	Yes	No	No	Yes	Yes
Copper	34	34	100%	4.80E+01	1.66E+03	5.51E+02	5.51E+02	NA	NA	4.09E+04	4.55E+01	Yes	No	No	Yes	Yes
Cyanide	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	1.23E+04	0.00E+00	No	No	No	No	No
Iron	8	8	100%	4.55E+04	2.72E+05	2.43E+05	2.43E+05	NA	NA	1.00E+05	3.22E+04	Yes	No	No	Yes	Yes
Lead	34	34	100%	1.48E+01	8.92E+04	9.28E+03	9.28E+03	NA	NA	8.00E+02	3.15E+01	Yes	No	No	Yes	Yes
Manganese	5	5	100%	5.59E+01	4.82E+03	2.14E+04	4.82E+03	NA	NA	1.95E+04	9.02E+02	Yes	No	No	Yes	Yes
Mercury	31	31	100%	5.00E-02	8.61E+00	2.03E+00	2.03E+00	NA	NA	3.07E+02	5.21E-01	Yes	No	No	Yes	Yes
Mercury, Methyl	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	6.16E+01	0.00E+00	No	No	No	No	No
Nickel	8	7	88%	7.90E+00	8.27E+01	4.38E+01	4.38E+01	2.50E+00	2.50E+00	2.04E+04	2.85E+01	Yes	No	No	Yes	Yes
Selenium	31	12	39%	1.00E-01	1.74E+01	3.55E+00	3.55E+00	5.00E-02	5.00E+00	5.11E+03	8.14E-01	Yes	Yes	No	Yes	Yes
Silver	31	29	94%	2.00E-01	3.07E+02	1.69E+02	1.69E+02	1.16E-01	1.50E+00	5.11E+03	4.07E-01	Yes	No	No	Yes	Yes
Thallium	8	7	88%	2.20E-01	5.80E+00	3.97E+00	3.97E+00	7.50E-01	7.50E-01	6.75E+01	0.00E+00	Yes	No	No	Yes	Yes
Vanadium	5	5	100%	5.94E+00	7.39E+01	5.37E+01	5.37E+01	NA	NA	1.02E+03	7.11E+01	Yes	No	No	Yes	Yes
Zinc	34	34	100%	2.10E+01	3.55E+03	9.95E+02	9.95E+02	NA	NA	1.00E+05	9.73E+01	Yes	No	No	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = NA, ND = ND.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A12. Data Summary and Initial Screening for Human Health Risk Assessment Surface Water Sampels - Near Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Surface Water Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/L														
Metals																		
Aluminum	5	0	0%	ND	ND	NA	0.00E+00	1.50E-02	1.50E-02	8.70E-02	3.65E+04	0.0E+00	No	No	No	No	No	No
Antimony	31	25	81%	6.00E-04	5.50E-03	3.33E-03	3.33E-03	2.00E-04	1.00E-02	1.00E+00	1.46E+01	3.44E-03	Yes	No	No	Yes	Yes	Yes
Arsenic III	2	2	100%	1.47E-04	2.43E-04	NA	2.43E-04	NA	NA	1.50E-01	No Data	4.95E-05	Yes	No	No	Yes	Yes	NA
Arsenic V	2	2	100%	9.25E-03	1.22E-02	NA	1.22E-02	NA	NA	1.50E-01	No Data	9.36E-04	Yes	No	No	Yes	Yes	NA
Arsenic, Total	31	30	97%	1.60E-03	6.85E-02	1.65E-02	1.65E-02	1.85E-04	1.85E-04	1.90E-01	4.48E-02	3.01E-03	Yes	No	No	Yes	Yes	Yes
Barium	5	4	80%	3.40E-03	5.90E-03	5.27E-03	5.27E-03	1.00E-03	1.00E-03	4.00E-03	2.55E+03	6.63E-03	Yes	No	No	No	No	No
Beryllium	11	0	0%	ND	ND	NA	0.00E+00	5.00E-05	1.00E-03	5.30E-03	7.30E+01	0.00E+00	No	No	No	No	No	No
Cadmium	31	1	3%	1.00E-04	1.00E-04	1.63E-04	1.00E-04	1.85E-05	1.00E-03	1.62E-04	1.82E+01	0.00E+00	No	Yes	No	Yes	Yes	No
Chromium, Total	26	0	0%	ND	ND	NA	0.00E+00	2.50E-04	5.00E-03	2.30E-02	No Data	0.00E+00	No	No	No	No	No	No
Cobalt	5	0	0%	ND	ND	NA	0.00E+00	3.00E-03	3.00E-03	2.30E-02	7.30E+02	0.00E+00	No	No	No	No	No	No
Copper	31	10	32%	2.60E-04	1.00E-02	4.33E-03	4.33E-03	2.50E-04	1.00E-02	1.34E-03	1.46E+03	2.38E-03	Yes	Yes	No	Yes	Yes	Yes
Iron	8	3	38%	3.00E-02	1.60E-01	9.22E-02	9.22E-02	3.00E-02	3.00E-02	1.00E+00	1.09E+04	0.00E+00	Yes	No	No	Yes	Yes	Yes
Lead	31	19	61%	8.00E-05	8.00E-04	4.07E-04	4.07E-04	5.00E-05	1.50E-03	1.53E-04	No Data	3.65E-04	Yes	Yes	No	Yes	Yes	Yes
Manganese	8	2	25%	5.00E-03	1.30E-02	7.33E-03	7.33E-03	2.00E-03	2.50E-03	1.20E-01	8.76E+02	0.00E+00	Yes	No	No	Yes	Yes	Yes
Mercury	26	20	77%	4.20E-07	2.00E-04	3.50E-05	3.50E-05	2.50E-05	2.50E-05	1.20E-05	1.09E+01	6.92E-06	Yes	Yes	No	Yes	Yes	Yes
Mercury, methyl	1	0	0%	ND	ND	NA	0.00E+00	1.00E-08	1.00E-08	5.00E-02	3.65E+00	0.00E+00	No	No	No	No	No	No
Nickel	16	5	31%	2.80E-04	1.40E-03	1.93E-03	1.40E-03	2.50E-04	5.00E-03	1.90E-02	7.30E+02	4.03E-03	Yes	No	No	No	No	No
Selenium	20	1	5%	2.00E-04	2.00E-04	7.00E-04	2.00E-04	5.00E-05	1.50E-03	5.00E-03	1.82E+02	0.00E+00	No	No	No	Yes	No	No
Silver	26	1	4%	5.00E-05	5.00E-05	8.96E-04	5.00E-05	2.50E-05	2.50E-03	1.20E-04	1.82E+02	0.00E+00	No	Yes	No	Yes	Yes	No
Thallium	11	0	0%	ND	ND	NA	0.00E+00	5.00E-05	1.00E-03	4.00E-02	2.41E+00	0.00E+00	No	No	No	No	No	No
Vanadium	5	0	0%	ND	ND	NA	0.00E+00	2.50E-03	2.50E-03	2.00E-02	3.65E+01	0.00E+00	No	No	No	No	No	No
Zinc	31	6	19%	3.10E-03	6.20E-03	5.12E-03	5.12E-03	2.50E-03	1.00E-02	1.26E-02	1.09E+04	5.24E-03	Yes	No	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A13. Data Summary and Initial Screening for Human Health Risk Assessment Surface Water Samples - Remote from Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Surface Water Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/L														
Metals																		
Aluminum	4	1	25%	1.16E+00	1.16E+00	NA	1.16E+00	1.50E-02	1.50E-02	8.70E-02	3.65E+04	0.0E+00	Yes	No	No	Yes	Yes	Yes
Antimony	18	16	89%	8.00E-04	3.12E-02	1.55E-02	1.55E-02	1.00E-02	1.00E-02	1.00E+00	1.46E+01	3.44E-03	Yes	No	No	Yes	Yes	Yes
Arsenic III	3	3	100%	1.25E-04	1.70E-03	NA	1.70E-03	NA	NA	1.50E-01	No Data	4.95E-05	Yes	No	No	Yes	Yes	NA
Arsenic V	3	3	100%	4.38E-03	1.36E+00	NA	1.36E+00	NA	NA	1.50E-01	No Data	9.36E-04	Yes	No	No	Yes	Yes	NA
Arsenic, Total	23	23	100%	2.80E-03	6.35E+00	1.82E+00	1.82E+00	NA	NA	1.90E-01	4.48E-02	3.01E-03	Yes	No	No	Yes	Yes	Yes
Barium	4	4	100%	2.50E-03	8.50E-03	NA	8.50E-03	NA	NA	4.00E-03	2.55E+03	6.63E-03	Yes	No	No	Yes	Yes	Yes
Beryllium	6	0	0%	ND	ND	NA	0.00E+00	5.00E-05	1.00E-03	5.30E-03	7.30E+01	0.00E+00	No	No	No	No	No	No
Cadmium	20	13	65%	1.40E-04	4.00E-02	1.50E-02	1.50E-02	1.85E-05	2.50E-03	1.62E-04	1.82E+01	0.00E+00	Yes	Yes	No	Yes	Yes	Yes
Chromium, Total	16	0	0%	ND	ND	NA	0.00E+00	2.50E-04	5.00E-03	2.30E-02	No Data	0.00E+00	No	No	No	No	No	No
Cobalt	4	1	25%	1.49E-02	1.49E-02	NA	1.49E-02	3.00E-03	3.00E-03	2.30E-02	7.30E+02	0.00E+00	Yes	No	No	Yes	Yes	Yes
Copper	23	13	57%	7.70E-04	2.64E+00	5.76E-01	5.76E-01	1.50E-03	5.00E-02	1.34E-03	1.46E+03	2.38E-03	Yes	Yes	No	Yes	Yes	Yes
Iron	17	13	76%	4.00E-02	4.80E+01	2.11E+01	2.11E+01	3.00E-02	5.00E-01	1.00E+00	1.09E+04	0.00E+00	Yes	No	No	Yes	Yes	Yes
Lead	23	17	74%	5.00E-05	5.62E-01	1.14E-01	1.14E-01	5.00E-05	5.00E-02	1.53E-04	No Data	3.65E-04	Yes	Yes	No	Yes	Yes	Yes
Manganese	12	9	75%	1.10E-02	4.23E+00	2.96E+00	2.96E+00	2.00E-03	2.50E-03	1.20E-01	8.76E+02	0.00E+00	Yes	No	No	Yes	Yes	Yes
Mercury	16	12	75%	8.80E-07	8.20E-04	2.04E-04	2.04E-04	2.50E-05	1.00E-04	1.20E-05	1.09E+01	6.92E-06	Yes	Yes	No	Yes	Yes	Yes
Mercury, methyl	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	5.00E-02	3.65E+00	0.00E+00	No	No	No	No	No	No
Nickel	8	4	50%	5.10E-04	1.30E-03	4.23E-03	1.30E-03	5.00E-03	5.00E-03	1.90E-02	7.30E+02	4.03E-03	Yes	No	No	No	No	No
Selenium	14	2	14%	1.00E-04	3.00E-04	6.26E-04	3.00E-04	5.00E-05	1.50E-03	5.00E-03	1.82E+02	0.00E+00	Yes	No	No	Yes	Yes	Yes
Silver	16	5	31%	8.00E-05	3.82E-03	1.26E-03	1.26E-03	2.50E-05	2.50E-03	1.20E-04	1.82E+02	0.00E+00	Yes	Yes	No	Yes	Yes	Yes
Thallium	6	1	17%	3.60E-04	3.60E-04	1.47E-03	3.60E-04	5.00E-05	1.00E-03	4.00E-02	2.41E+00	0.00E+00	Yes	No	No	Yes	Yes	Yes
Vanadium	4	0	0%	ND	ND	NA	0.00E+00	2.50E-03	2.50E-03	2.00E-02	3.65E+01	0.00E+00	No	No	No	No	No	No
Zinc	23	17	74%	7.90E-03	6.59E+00	2.40E+00	2.40E+00	5.00E-03	5.00E-02	1.26E-02	1.09E+04	5.24E-03	Yes	Yes	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A14. Data Summary and Initial Screening for Human Health Risk Assessment Drinking Water Scenario - Near Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Human Health Chemical of Interest?
				mg/L												
Metals																
Aluminum	5	0	0%	ND	ND	NA	0.00E+00	1.50E-02	1.50E-02	3.65E+04	0.0E+00	No	No	No	No	No
Antimony	29	24	83%	6.00E-04	5.50E-03	3.56E-03	3.56E-03	2.50E-03	1.00E-02	1.46E+01	3.44E-03	Yes	No	No	Yes	Yes
Arsenic III	2	2	100%	1.47E-04	2.43E-04	NA	2.43E-04	NA	NA	No Data	4.95E-05	Yes	No	No	Yes	NA
Arsenic V	2	2	100%	9.25E-03	1.22E-02	NA	1.22E-02	NA	NA	No Data	9.36E-04	Yes	No	No	Yes	NA
Arsenic, Total	31	30	97%	1.60E-03	6.85E-02	1.67E-02	1.67E-02	1.85E-04	1.85E-04	4.48E-02	3.01E-03	Yes	No	No	Yes	Yes
Barium	5	4	80%	3.40E-03	5.90E-03	4.77E-03	4.77E-03	1.00E-03	1.00E-03	2.55E+03	6.63E-03	Yes	No	No	No	No
Beryllium	11	0	0%	ND	ND	NA	0.00E+00	5.00E-05	1.00E-03	7.30E+01	0.00E+00	No	No	No	No	No
Cadmium	29	0	0%	ND	ND	NA	0.00E+00	1.85E-05	1.00E-03	1.82E+01	0.00E+00	No	Yes	No	No	No
Chromium, Total	24	0	0%	ND	ND	NA	0.00E+00	2.50E-04	5.00E-03	No Data	0.00E+00	No	No	No	No	No
Cobalt	5	0	0%	ND	ND	NA	0.00E+00	3.00E-03	3.00E-03	7.30E+02	0.00E+00	No	No	No	No	No
Copper	31	11	35%	2.60E-04	1.00E-02	3.82E-03	3.82E-03	2.50E-04	1.00E-02	1.46E+03	2.38E-03	Yes	Yes	No	Yes	Yes
Iron	6	1	17%	6.00E-02	6.00E-02	4.32E-02	4.32E-02	3.00E-02	3.00E-02	1.09E+04	0.00E+00	Yes	No	No	Yes	Yes
Lead	31	18	58%	2.00E-05	8.00E-04	3.79E-04	3.79E-04	1.00E-05	1.50E-03	No Data	3.65E-04	Yes	Yes	No	Yes	Yes
Manganese	6	0	0%	ND	ND	NA	0.00E+00	2.00E-03	2.50E-03	8.76E+02	0.00E+00	No	No	No	No	No
Mercury	26	20	77%	4.20E-07	2.00E-04	3.46E-05	3.46E-05	2.50E-05	2.50E-05	1.09E+01	6.92E-06	Yes	Yes	No	Yes	Yes
Mercury, methyl	1	0	0%	ND	ND	NA	0.00E+00	1.00E-08	1.00E-08	3.65E+00	0.00E+00	No	No	No	No	No
Nickel	16	5	31%	2.80E-04	1.40E-03	1.94E-03	1.40E-03	2.50E-04	5.00E-03	7.30E+02	4.03E-03	Yes	No	No	No	No
Selenium	18	0	0%	ND	ND	NA	0.00E+00	5.00E-05	1.50E-03	1.82E+02	0.00E+00	No	No	No	No	No
Silver	24	1	4%	5.00E-05	5.00E-05	9.65E-04	5.00E-05	2.50E-05	2.50E-03	1.82E+02	0.00E+00	No	Yes	No	Yes	No
Thallium	11	0	0%	ND	ND	NA	0.00E+00	5.00E-05	1.00E-03	2.41E+00	0.00E+00	No	No	No	No	No
Vanadium	5	0	0%	ND	ND	NA	0.00E+00	2.50E-03	2.50E-03	3.65E+01	0.00E+00	No	No	No	No	No
Zinc	31	8	26%	3.10E-03	6.20E-03	5.14E-03	5.14E-03	2.50E-03	1.00E-02	1.09E+04	5.24E-03	Yes	No	No	Yes	Yes

NOTES:
Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A15. Data Summary and Initial Screening for Human Health Risk Assessment Drinking Water Scenario - Remote from Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Human Health Chemical of Interest?
				mg/L												
Metals																
Aluminum	2	0	0%	ND	ND	NA	0.00E+00	1.50E-02	1.50E-02	3.65E+04	0.0E+00	No	No	No	No	No
Antimony	6	4	67%	1.30E-03	2.50E-02	1.39E-02	1.39E-02	1.00E-02	1.00E-02	1.46E+01	3.44E-03	Yes	No	No	Yes	Yes
Arsenic III	1	1	100%	1.25E-04	1.25E-04	NA	1.25E-04	NA	NA	No Data	4.95E-05	Yes	No	No	Yes	NA
Arsenic V	1	1	100%	4.38E-03	4.38E-03	NA	4.38E-03	NA	NA	No Data	9.36E-04	Yes	No	No	Yes	NA
Arsenic, Total	6	6	100%	2.80E-03	4.06E+00	2.57E+00	2.57E+00	NA	NA	4.48E-02	3.01E-03	Yes	No	No	Yes	Yes
Barium	2	2	100%	8.30E-03	8.50E-03	NA	8.50E-03	NA	NA	2.55E+03	6.63E-03	Yes	No	No	Yes	Yes
Beryllium	2	0	0%	ND	ND	NA	0.00E+00	1.00E-03	1.00E-03	7.30E+01	0.00E+00	No	No	No	No	No
Cadmium	6	1	17%	7.70E-03	7.70E-03	5.00E-03	5.00E-03	1.85E-05	1.00E-03	1.82E+01	0.00E+00	Yes	Yes	No	Yes	Yes
Chromium, Total	5	0	0%	ND	ND	NA	0.00E+00	3.00E-03	5.00E-03	No Data	0.00E+00	No	No	No	No	No
Cobalt	2	0	0%	ND	ND	NA	0.00E+00	3.00E-03	3.00E-03	7.30E+02	0.00E+00	No	No	No	No	No
Copper	6	2	33%	7.70E-04	4.10E-01	2.61E-01	2.61E-01	5.00E-03	5.00E-03	1.46E+03	2.38E-03	Yes	Yes	No	Yes	Yes
Iron	3	1	33%	2.29E+01	2.29E+01	NA	2.29E+01	3.00E-02	3.00E-02	1.09E+04	0.00E+00	Yes	No	No	Yes	Yes
Lead	6	3	50%	5.00E-05	1.25E-01	7.94E-02	7.94E-02	5.00E-05	1.50E-03	No Data	3.65E-04	Yes	Yes	No	Yes	Yes
Manganese	3	1	33%	5.22E-01	5.22E-01	NA	5.22E-01	2.00E-03	2.00E-03	8.76E+02	0.00E+00	Yes	No	No	Yes	Yes
Mercury	5	5	100%	8.80E-07	8.20E-04	6.26E-04	6.26E-04	NA	NA	1.09E+01	6.92E-06	Yes	No	No	Yes	Yes
Mercury, methyl	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	3.65E+00	0.00E+00	No	No	No	No	No
Nickel	3	1	33%	5.10E-04	5.10E-04	NA	5.10E-04	5.00E-03	5.00E-03	7.30E+02	4.03E-03	Yes	No	No	No	No
Selenium	5	1	20%	3.00E-04	3.00E-04	#VALUE!	3.00E-04	5.00E-05	1.50E-03	1.82E+02	0.00E+00	Yes	No	No	Yes	Yes
Silver	5	1	20%	3.82E-03	3.82E-03	1.87E-03	1.87E-03	2.50E-05	2.50E-03	1.82E+02	0.00E+00	Yes	Yes	No	Yes	Yes
Thallium	2	0	0%	ND	ND	NA	0.00E+00	1.00E-03	1.00E-03	2.41E+00	0.00E+00	No	No	No	No	No
Vanadium	2	0	0%	ND	ND	NA	0.00E+00	2.50E-03	2.50E-03	3.65E+01	0.00E+00	No	No	No	No	No
Zinc	6	2	33%	7.90E-03	1.22E+00	#VALUE!	1.22E+00	5.00E-03	5.00E-03	1.09E+04	5.24E-03	Yes	No	No	Yes	Yes

NOTES:
Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A16. Data Summary and Initial Screening for Human Health Risk Assessment Pore Water Samples - Near Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Surface Water Ecological Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?
				mg/L											
Metals															
Aluminum	5	1	20%	4.50E-02	4.50E-02	3.38E-02	3.38E-02	1.50E-02	1.50E-02	8.70E-02	0.00E+00	Yes	No	Yes	Yes
Antimony	12	7	58%	2.60E-03	6.30E-03	4.96E-03	4.96E-03	2.50E-03	1.00E-02	1.00E+00	0.00E+00	Yes	No	Yes	Yes
Arsenic III	4	2	50%	1.60E-05	1.38E-04	NA	1.38E-04	4.00E-06	4.00E-06	1.50E-01	0.00E+00	Yes	No	Yes	Yes
Arsenic V	4	2	50%	7.46E-03	1.03E-02	NA	1.03E-02	5.30E-03	7.90E-03	1.50E-01	0.00E+00	Yes	No	Yes	Yes
Arsenic, Total	12	12	100%	7.60E-03	2.82E+00	8.80E-01	8.80E-01	NA	NA	1.90E-01	0.00E+00	Yes	No	Yes	Yes
Barium	5	4	80%	3.30E-03	5.70E-03	5.43E-03	5.43E-03	1.00E-03	1.00E-03	4.00E-03	1.82E-02	Yes	No	No	No
Beryllium	5	0	0%	ND	ND	NA	0.00E+00	1.00E-03	1.00E-03	5.30E-03	0.00E+00	No	No	No	No
Cadmium	12	0	0%	ND	ND	NA	0.00E+00	2.50E-05	1.00E-03	1.62E-04	0.00E+00	No	Yes	No	Yes
Chromium VI	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	1.00E-02	1.00E-02	No	No	No	No
Chromium, Total	12	0	0%	ND	ND	NA	0.00E+00	3.00E-03	5.00E-03	2.30E-02	0.00E+00	No	No	No	No
Cobalt	5	0	0%	ND	ND	NA	0.00E+00	3.00E-03	3.00E-03	2.30E-02	0.00E+00	No	No	No	No
Copper	12	0	0%	ND	ND	NA	0.00E+00	5.00E-05	5.00E-03	1.34E-03	0.00E+00	No	Yes	No	Yes
Iron	5	0	0%	ND	ND	NA	0.00E+00	3.00E-02	3.00E-02	1.00E+00	0.00E+00	No	No	No	No
Lead	12	1	8%	2.00E-04	2.00E-04	1.04E-03	2.00E-04	5.00E-05	1.50E-03	1.53E-04	0.00E+00	Yes	Yes	Yes	Yes
Magnesium	12	12	100%	2.66E-01	1.50E+00	6.90E-01	6.90E-01	NA	NA	8.20E+01	3.94E-01	Yes	No	Yes	Yes
Manganese	5	0	0%	ND	ND	NA	0.00E+00	2.00E-03	2.00E-03	1.20E-01	3.27E-03	No	No	No	No
Mercury	12	12	100%	3.20E-07	1.40E-06	1.03E-06	1.03E-06	NA	NA	1.20E-05	1.21E-06	Yes	No	Yes	Yes
Mercury, methyl	1	0	0%	ND	ND	NA	0.00E+00	1.00E-08	1.00E-08	5.00E-02	0.00E+00	No	No	No	No
Nickel	5	0	0%	ND	ND	NA	0.00E+00	2.50E-03	5.00E-03	1.90E-02	0.00E+00	No	No	No	No
Selenium	12	0	0%	ND	ND	NA	0.00E+00	5.00E-05	1.50E-03	5.00E-03	0.00E+00	No	No	No	No
Silver	12	0	0%	ND	ND	NA	0.00E+00	2.50E-05	2.50E-03	1.20E-04	0.00E+00	No	Yes	No	Yes
Thallium	5	0	0%	ND	ND	NA	0.00E+00	1.00E-03	1.00E-03	4.00E-02	0.00E+00	No	No	No	No
Vanadium	5	0	0%	ND	ND	NA	0.00E+00	2.50E-03	2.50E-03	2.00E-02	0.00E+00	No	No	No	No
Zinc	12	1	8%	1.00E-02	1.00E-02	6.16E-03	6.16E-03	5.00E-03	5.00E-03	1.26E-02	9.33E-03	Yes	No	Yes	Yes

NOTES:
Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A17. Data Summary and Initial Screening for Human Health Risk Assessment Pore Water Samples - Remote from Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Surface Water Ecological Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?
				mg/L											
Metals															
Aluminum	1	0	0%	ND	ND	NA	0.00E+00	1.50E-02	1.50E-02	8.70E-02	0.00E+00	No	No	No	No
Antimony	1	0	0%	ND	ND	NA	0.00E+00	1.00E-02	1.00E-02	1.00E+00	0.00E+00	No	No	No	No
Arsenic III	1	1	100%	2.10E-05	2.10E-05	NA	2.10E-05	NA	NA	1.50E-01	0.00E+00	Yes	No	Yes	Yes
Arsenic V	1	1	100%	3.78E-03	3.78E-03	NA	3.78E-03	NA	NA	1.50E-01	0.00E+00	Yes	No	Yes	Yes
Arsenic, Total	1	1	100%	3.80E-03	3.80E-03	NA	3.80E-03	NA	NA	1.90E-01	0.00E+00	Yes	No	Yes	Yes
Barium	1	1	100%	9.60E-03	9.60E-03	NA	9.60E-03	NA	NA	4.00E-03	1.82E-02	Yes	No	No	No
Beryllium	1	0	0%	ND	ND	NA	0.00E+00	1.00E-03	1.00E-03	5.30E-03	0.00E+00	No	No	No	No
Cadmium	1	0	0%	ND	ND	NA	0.00E+00	1.00E-03	1.00E-03	1.62E-04	0.00E+00	No	Yes	No	Yes
Chromium VI	1	1	100%	2.00E-02	2.00E-02	NA	2.00E-02	NA	NA	1.00E-02	1.00E-02	Yes	No	Yes	Yes
Chromium, Total	1	0	0%	ND	ND	NA	0.00E+00	3.00E-03	3.00E-03	2.30E-02	0.00E+00	No	No	No	No
Cobalt	1	0	0%	ND	ND	NA	0.00E+00	3.00E-03	3.00E-03	2.30E-02	0.00E+00	No	No	No	No
Copper	1	0	0%	ND	ND	NA	0.00E+00	5.00E-03	5.00E-03	1.34E-03	0.00E+00	No	Yes	No	Yes
Iron	1	0	0%	ND	ND	NA	0.00E+00	3.00E-02	3.00E-02	1.00E+00	0.00E+00	No	No	No	No
Lead	1	0	0%	ND	ND	NA	0.00E+00	1.50E-03	1.50E-03	1.53E-04	0.00E+00	No	Yes	No	Yes
Magnesium	1	1	100%	3.84E-01	3.84E-01	NA	3.84E-01	NA	NA	8.20E+01	3.94E-01	Yes	No	No	No
Manganese	1	0	0%	ND	ND	NA	0.00E+00	2.00E-03	2.00E-03	1.20E-01	3.27E-03	No	No	No	No
Mercury	1	1	100%	8.70E-07	8.70E-07	NA	8.70E-07	NA	NA	1.20E-05	1.21E-06	Yes	No	No	No
Mercury, methyl	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	5.00E-02	0.00E+00	No	No	No	No
Nickel	1	0	0%	ND	ND	NA	0.00E+00	5.00E-03	5.00E-03	1.90E-02	0.00E+00	No	No	No	No
Selenium	1	0	0%	ND	ND	NA	0.00E+00	1.50E-03	1.50E-03	5.00E-03	0.00E+00	No	No	No	No
Silver	1	0	0%	ND	ND	NA	0.00E+00	2.50E-03	2.50E-03	1.20E-04	0.00E+00	No	Yes	No	Yes
Thallium	1	0	0%	ND	ND	NA	0.00E+00	1.00E-03	1.00E-03	4.00E-02	0.00E+00	No	No	No	No
Vanadium	1	0	0%	ND	ND	NA	0.00E+00	2.50E-03	2.50E-03	2.00E-02	0.00E+00	No	No	No	No
Zinc	1	0	0%	ND	ND	NA	0.00E+00	5.00E-03	5.00E-03	1.26E-02	9.33E-03	No	No	No	No

NOTES:
Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A18. Data Summary and Initial Screening for Human Health Risk Assessment Sediment Samples - Near Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Sediment Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/kg														
Metals																		
Aluminum	5	5	100%	1.34E+04	1.71E+04	1.66E+04	1.66E+04	NA	NA	No Data	1.00E+05	1.25E+04	Yes	No	No	Yes	Yes	Yes
Antimony	34	34	100%	8.50E-03	5.10E+01	1.87E+01	1.87E+01	NA	NA	3.00E+00	4.09E+02	6.73E+00	Yes	No	No	Yes	Yes	Yes
Arsenic III	5	5	100%	8.20E-04	4.27E-03	3.59E-03	3.59E-03	NA	NA	4.00E+00	No Data	4.42E-04	Yes	No	No	Yes	Yes	Yes
Arsenic V	5	5	100%	2.69E+02	5.44E+02	4.96E+02	4.96E+02	NA	NA	4.00E+00	No Data	9.58E+01	Yes	No	No	Yes	Yes	Yes
Arsenic, total	34	34	100%	2.81E-01	1.09E+03	3.99E+02	3.99E+02	NA	NA	4.00E+00	1.59E+00	1.34E+02	Yes	No	No	Yes	Yes	Yes
Barium	15	15	100%	5.28E+01	1.06E+02	8.84E+01	8.84E+01	NA	NA	No Data	6.66E+04	8.15E+01	Yes	No	No	Yes	Yes	Yes
Beryllium	6	4	67%	1.70E-01	2.30E-01	2.18E-01	2.18E-01	1.00E-01	1.00E-01	1.22E+02	1.94E+03	1.45E-01	Yes	No	No	Yes	Yes	Yes
Cadmium	34	34	100%	3.30E-01	3.90E+00	1.47E+00	1.47E+00	NA	NA	3.00E-03	4.51E+02	1.15E+00	Yes	No	No	Yes	Yes	Yes
Chromium, Total	34	34	100%	1.80E+01	6.50E+01	4.62E+01	4.62E+01	NA	NA	3.70E+01	4.48E+02	4.77E+01	Yes	No	No	Yes	Yes	Yes
Cobalt	5	5	100%	1.05E+01	1.25E+01	1.20E+01	1.20E+01	NA	NA	No Data	1.92E+03	9.54E+00	Yes	No	No	Yes	Yes	Yes
Copper	34	34	100%	1.20E+01	2.07E+02	9.39E+01	9.39E+01	NA	NA	1.00E+01	4.09E+04	3.27E+01	Yes	No	No	Yes	Yes	Yes
Iron	15	15	100%	2.45E+04	3.14E+04	2.98E+04	2.98E+04	NA	NA	4.00E+04	1.00E+05	2.59E+04	Yes	No	No	Yes	Yes	Yes
Lead	34	34	100%	2.08E+01	2.78E+02	1.12E+02	1.12E+02	NA	NA	3.50E+01	8.00E+02	6.47E+01	Yes	No	No	Yes	Yes	Yes
Manganese	15	15	100%	6.16E+02	1.23E+03	8.81E+02	8.81E+02	NA	NA	1.10E+03	1.95E+04	1.20E+03	Yes	No	No	Yes	Yes	Yes
Mercury	19	11	58%	9.10E-02	2.30E-01	1.27E-01	1.27E-01	2.50E-02	2.50E-02	2.00E-01	3.07E+02	4.41E-01	Yes	No	No	No	No	No
Mercury, Methyl	3	1	33%	1.70E-05	1.70E-05	NA	1.70E-05	6.00E-06	6.00E-06	No Data	6.16E+01	0.00E+00	Yes	No	No	Yes	Yes	Yes
Nickel	6	6	100%	1.02E+01	9.65E+01	6.54E+01	6.54E+01	NA	NA	1.80E+01	2.04E+04	1.25E+01	Yes	No	No	Yes	Yes	Yes
Selenium	24	21	88%	8.00E-02	4.60E-01	2.66E-01	2.66E-01	1.50E-01	2.50E-01	1.00E-01	5.11E+03	5.44E-01	Yes	No	No	No	No	No
Silver	24	19	79%	1.70E-01	6.94E+00	1.71E+00	1.71E+00	2.50E-01	2.50E-01	4.50E+00	5.11E+03	1.91E-01	Yes	No	No	Yes	Yes	Yes
Thallium	6	1	17%	1.70E-01	1.70E-01	1.35E-01	1.35E-01	1.00E-01	1.00E-01	7.00E-01	6.75E+01	1.51E-01	Yes	No	No	Yes	Yes	Yes
Vanadium	5	5	100%	5.07E+01	6.62E+01	6.43E+01	6.43E+01	NA	NA	No Data	1.02E+03	4.91E+01	Yes	No	No	Yes	Yes	Yes
Zinc	34	34	100%	8.10E+01	8.06E+02	2.25E+02	2.25E+02	NA	NA	3.00E+00	1.00E+05	1.22E+02	Yes	No	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix A19. Data Summary and Initial Screening for Human Health Risk Assessment Sediment Samples - Remote from Townsite
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	95% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Sediment Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Background Concentration	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/kg														
Metals																		
Aluminum	2	2	100%	9.96E+03	1.19E+04	NA	1.19E+04	NA	NA	No Data	1.00E+05	1.25E+04	Yes	No	No	No	No	No
Antimony	6	6	100%	4.80E+00	1.63E+01	1.26E+01	1.26E+01	NA	NA	3.00E+00	4.09E+02	6.73E+00	Yes	No	No	Yes	Yes	Yes
Arsenic III	2	2	100%	1.44E-03	3.14E-03	NA	3.14E-03	NA	NA	4.00E+00	No Data	4.42E-04	Yes	No	No	Yes	Yes	Yes
Arsenic V	2	2	100%	2.50E+02	3.67E+02	NA	3.67E+02	NA	NA	4.00E+00	No Data	9.58E+01	Yes	No	No	Yes	Yes	Yes
Arsenic, total	6	6	100%	4.21E+01	3.67E+02	2.89E+02	2.89E+02	NA	NA	4.00E+00	1.59E+00	1.34E+02	Yes	No	No	Yes	Yes	Yes
Barium	2	2	100%	9.40E+01	9.84E+01	NA	9.84E+01	NA	NA	No Data	6.66E+04	8.15E+01	Yes	No	No	Yes	Yes	Yes
Beryllium	2	2	100%	2.10E-01	2.30E-01	NA	2.30E-01	NA	NA	1.22E+02	1.94E+03	1.45E-01	Yes	No	No	Yes	Yes	Yes
Cadmium	6	6	100%	2.50E-01	1.91E+00	1.58E+00	1.58E+00	NA	NA	3.00E-03	4.51E+02	1.15E+00	Yes	No	No	Yes	Yes	Yes
Chromium, Total	6	6	100%	1.20E+01	4.89E+01	4.08E+01	4.08E+01	NA	NA	3.70E+01	4.48E+02	4.77E+01	Yes	No	No	Yes	Yes	Yes
Cobalt	2	2	100%	9.56E+00	1.00E+01	NA	1.00E+01	NA	NA	No Data	1.92E+03	9.54E+00	Yes	No	No	Yes	Yes	Yes
Copper	6	6	100%	1.30E+01	6.75E+01	5.25E+01	5.25E+01	NA	NA	1.00E+01	4.09E+04	3.27E+01	Yes	No	No	Yes	Yes	Yes
Iron	2	2	100%	2.52E+04	2.55E+04	NA	2.55E+04	NA	NA	4.00E+04	1.00E+05	2.59E+04	Yes	No	No	No	No	No
Lead	6	6	100%	7.88E+00	8.48E+01	7.62E+01	7.62E+01	NA	NA	3.50E+01	8.00E+02	6.47E+01	Yes	No	No	Yes	Yes	Yes
Manganese	2	2	100%	1.35E+03	1.51E+03	NA	1.51E+03	NA	NA	1.10E+03	1.95E+04	1.20E+03	Yes	No	No	Yes	Yes	Yes
Mercury	4	4	100%	2.60E-01	4.60E+00	NA	4.60E+00	NA	NA	2.00E-01	3.07E+02	4.41E-01	Yes	No	No	Yes	Yes	Yes
Mercury, Methyl	0	0	0%	ND	ND	NA	0.00E+00	NA	NA	No Data	6.16E+01	0.00E+00	No	No	No	No	No	No
Nickel	2	2	100%	1.15E+01	1.17E+01	NA	1.17E+01	NA	NA	1.80E+01	2.04E+04	1.25E+01	Yes	No	No	No	No	No
Selenium	6	5	83%	8.00E-02	4.60E-01	3.53E-01	3.53E-01	2.50E-02	2.50E-02	1.00E-01	5.11E+03	5.44E-01	Yes	No	No	No	No	No
Silver	6	4	67%	6.00E-02	5.20E-01	3.70E-01	3.70E-01	2.50E-01	2.50E-01	4.50E+00	5.11E+03	1.91E-01	Yes	No	No	Yes	Yes	Yes
Thallium	2	2	100%	2.48E-01	2.80E-01	NA	2.80E-01	NA	NA	7.00E-01	6.75E+01	1.51E-01	Yes	No	No	Yes	Yes	Yes
Vanadium	2	2	100%	4.77E+01	4.94E+01	NA	4.94E+01	NA	NA	No Data	1.02E+03	4.91E+01	Yes	No	No	Yes	Yes	Yes
Zinc	6	6	100%	6.60E+01	1.85E+02	1.72E+02	1.72E+02	NA	NA	3.00E+00	1.00E+05	1.22E+02	Yes	No	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable, ND = not detected.
1 Upper confidence limit on the mean or maximum (whichever is lower).

Appendix B.

Human Health Risk Calculations

Appendix B1. Preliminary Remediation Goal Screening
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Media: Soil				Media: Subsurface soil				Media: Sediment				Media: Surface Water			
	Risk Based Screening Value	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?	Preliminary Remediation Goal**	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?	Preliminary Remediation Goal**	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?	Preliminary Remediation Goal**	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?
	mg/kg	mg/kg			mg/kg	mg/kg			mg/kg	mg/kg			µg/L	µg/L		
Aluminum	9.9E+05		0.0E+00	no	9.9E+05	2.67E+01	2.7E-05	no	9.9E+05	1.6E+04	1.6E-02	no	3.7E+04	4.87E+02	1.3E-02	no
Antimony	4.1E+02	1.97E+03	4.8E+00	**YES**	4.1E+02	1.06E+01	2.6E-02	no	4.1E+02	1.8E+01	4.5E-02	no	1.5E+01	8.58E+00	5.7E-01	no
Arsenic	1.6E+00	2.12E+04	1.3E+04	**YES**	1.6E+00	3.90E-01	2.5E-01	no	1.6E+00	3.9E+02	2.5E+02	**YES**	4.5E-02	6.83E+02	1.5E+04	**YES**
Barium	1.9E+05	1.94E+02	1.0E-03	no	1.9E+05	8.73E+01	4.6E-04	no	1.9E+05	9.0E+01	4.7E-04	no	7.3E+03	6.06E+00	8.3E-04	no
Beryllium	1.9E+03	4.99E-01	2.6E-04	no	1.9E+03	6.00E-01	3.1E-04	no	1.9E+03	2.1E-01	1.1E-04	no	7.3E+01		0.0E+00	no
Cadmium	8.1E+02	6.37E+00	7.9E-03	no	8.1E+02	4.17E+00	5.1E-03	no	8.1E+02	1.5E+00	1.8E-03	no	1.8E+01	4.95E+00	2.7E-01	no
Chromium	1.4E+03	3.95E+01	2.8E-02	no	1.4E+03	9.21E+00	6.6E-03	no	1.4E+03	4.5E+01	3.2E-02	no	1.0E-03		0.0E+00	no
Cobalt	3.0E+02	7.19E+00	2.4E-02	no	3.0E+02	1.84E+00	6.1E-03	no	3.0E+02	1.1E+01	3.8E-02	no	1.1E+01	7.91E+00	7.2E-01	no
Copper	4.1E+04	6.24E+02	1.5E-02	no	4.1E+04	9.21E+00	2.3E-04	no	4.1E+04	9.1E+01	2.2E-03	no	1.5E+03	2.46E+02	1.7E-01	no
Iron	7.2E+05	8.25E+04	1.1E-01	no	7.2E+05	6.09E+02	8.5E-04	no	7.2E+05	3.0E+04	4.1E-02	no	2.6E+04	1.02E+04	3.9E-01	no
Lead	8.0E+02	7.29E+03	9.1E+00	**YES**	8.0E+02	2.45E-02	3.1E-05	no	8.0E+02	1.1E+02	1.4E-01	no	NA	4.70E+01	NA	**YES**
Manganese	2.3E+04	6.85E+02	3.0E-02	no	2.3E+04	2.45E-02	1.1E-06	no	2.3E+04	9.9E+02	4.3E-02	no	8.8E+02	9.73E+02	1.1E+00	YES
Methyl Mercury	1.0E+02		0.0E+00	no	1.0E+02	4.00E-02	4.0E-04	no	1.0E+02	1.7E-05	1.7E-07	no	3.7E+00		0.0E+00	no
Mercury	3.1E+02	3.30E+00	1.1E-02	no	3.1E+02	2.45E-02	8.0E-05	no	3.1E+02	9.4E-01	3.1E-03	no	3.1E+02	8.37E-02	2.7E-04	no
Nickel	2.0E+04	2.12E+01	1.1E-03	no	2.0E+04	4.17E-02	2.1E-06	no	2.0E+04	5.2E+01	2.6E-03	no	2.0E+04		0.0E+00	no
Selenium	5.1E+03	2.12E+00	4.2E-04	no	5.1E+03	7.72E-02	1.5E-05	no	5.1E+03		0.0E+00	no	1.8E+02	3.00E-01	1.7E-03	no
Silver	5.1E+03	8.30E+01	1.6E-02	no	5.1E+03	3.56E-02	7.0E-06	no	5.1E+03	1.7E+00	3.4E-04	no	1.8E+02	8.65E-01	4.8E-03	no
Thallium	6.6E+01	3.82E+00	5.8E-02	no	6.6E+01	3.57E-02	5.4E-04	no	6.6E+01	2.0E-01	3.0E-03	no	6.6E+01	3.60E-01	5.5E-03	no
Vanadium	5.2E+03	4.05E+01	7.8E-03	no	5.2E+03		0.0E+00	no	5.2E+03	6.1E+01	1.2E-02	no	2.6E+02		0.0E+00	no
Zinc	3.1E+05	7.14E+02	2.3E-03	no	3.1E+05	3.57E-02	1.2E-07	no	3.1E+05	2.22E+02	7.2E-04	no	1.1E+04	1.05E+03	9.5E-02	no

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, mg/L = milligrams per liter, NA = not applicable, µg/L = micrograms per liter.
Shading = Not Applicable for this medium and/or chemical.

Appendix B2. Summary of Exposure Factors
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Exposure Factors	Receptor				Source
	Child		Adult		
	Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure	
Body Weight (kg)	15	15	70	70	EPA, 1997
Exposure Frequency (d/yr) - soil	6	12	6	12	Site Specific
Exposure Frequency (d/yr) - sediment	6	12	6	12	Site Specific
Exposure Frequency (d/yr) - surface water	6	12	6	12	Site Specific
Event time (hours per event) - soil	1	2	2	2	Site Specific
Event Frequency (events per day)	1	1	1	1	Site Specific
Exposure Duration (yr)	6	6	9	24	EPA, 1997
Averaging Time (d) [1]					
carcinogens	25,550	25,550	25,550	25,550	EPA, 1989
noncarcinogens	2,190	2,190	3,285	8,760	EPA, 1989
Intake Factors					
Ingestion of soil (mg/d)	100	200	50	100	EPA, 1997
Incidental ingestion of sediment (mg/d)	50	100	25	50	EPA, 1997
Incidental surface water ingestion (L/hr)	0.05	0.05	0.05	0.05	EPA, 1997
Exposed skin surface area (cm^2)	6,600	7,300	18,000	22,000	EPA, 2004a
Inhalation rate (m^3/d)	8.3	8.3	15.2	15.2	EPA, 1997
Dermal absorption factor					
volatile vp> 12000 Pa	0.0005	0.0005	0.0005	0.0005	EPA, 2004a
volatile vp< 12000 Pa	0.03	0.03	0.03	0.03	EPA, 2004a
inorganics	0.1	0.01	0.01	0.01	EPA, 2004a
Rags Part E GI ABS					
Antimony (soil)	0.15	0.15	0.15	0.15	EPA, 2004a
Manganese (water)	0.04	0.04	0.04	0.04	EPA, 2004a
Soil Adherence Factor (mg/cm^2-event)	0.01	0.07	0.01	0.07	EPA, 2004a
PEF (mg^3/kg)	1.32E+09	1.32E+09	1.32E+09	1.32E+09	EPA, 2004a

NOTES:
Abbreviations: cm^2 = square centimeters, d = day, d/yr = days per year, kg = kilograms, L/hr = liters per hour, m^3/d = cubic meters per day, mg/cm^2 = milligrams per square centimeter, mg^3/kg = cubic milligrams per kilogram, mg/d = milligrams per day, Pa = Pascal, PEF = Particulate Emission Factor, vp = vapor pressure, yr = year.
1 Averaging Time = Exposure Duration (yrs) X 365 days per year.

SOURCES:
EPA, 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). EPA/540/1-89/002.
EPA, 1997. "Exposure Factors Handbook". Volumes I - III. EPA Office of Research and Development. August
EPA, 2004a. "Risk Assessment Guide for Superfund, Part E, Supplemental Guidance for Dermal Risk Assessment." July
EPA, 2004b. "Region IV Preliminary Remediation Goals". 2004 Update. EPA. December

Appendix B3. Noncarcinogenic Calculation of Dermal Intake
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Dermal Contact with Soil and Sediment

Chemical of Interest	Dermal Absorption Factor	Conversion Factor	Adherence Factors		Dermal Absorption Values	
			Central Tendancy Exposure	Reasonable Maximum Exposure	Central Tendancy Exposure	Reasonable Maximum Exposure
	unitless	kg/mg	mg/cm^2 - event		mg/cm^2 - event	
Antimony	Evaulation criteria not sufficiently established http://www.nj.gov/dep/srp/regs/rs/bb_ingest_dermal.pdf					
Arsenic	0.01	0.000001	1.00E-02	7.00E-02	1.00E-10	7.00E-10
Manganese	Not a significant route of exposure http://www.inchem.org/documents/cicads/cicads/cicad12.htm					

Dermal Contact with Surface Water

Chemical of Interest	Kp	Conversion Factor (kg/mg)	t event	DA water
Arsenic	0.002	0.001	2	0.000004
Manganese	0.002	0.001	2	0.000004

NOTE:
Abbreviations: DA = Dermal Absorption, kg/mg = kilograms per miligram, mg/cm^2 = milligrams per cubic centimeter, Kp = chemical-specific dermal permeability coefficient from water, cm^2/hr = square centimeters/hour

Appendix B4. Carcinogenic Calculation of Dermal Intake
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Dermal Contact with Soil and Sediment

Chemical of Interest	Dermal Absorption Factor	Conversion Factor	Adherence Factors		Dermal Absorption Values	
			Central Tendancy Exposure	Reasonable Maximum Exposure	Central Tendancy Exposure	Reasonable Maximum Exposure
	unitless	kg/mg	mg/cm^2 - event		mg/cm^2 - event	
Arsenic	0.01	0.000001	1.00E-02	7.00E-02	1.00E-10	7.00E-10

Dermal Contact with Surface Water

Chemical of Interest	Kp	Conversion Factor (kg/mg)	t event	DA water
Arsenic	0.002	0.001	2	0.000004

NOTE:
Abbreviations: DA = Dermal Absorption, kg/mg = kilograms per miligram, mg/cm^2 = milligrams per cubic centimeter, Kp = chemical-specific dermal permeability coefficient from water, cm^2/hr = square centimeters/hour

Appendix B5. Intake Calculations
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Exposure Routes (Recreational)	Carcinogen		Noncarcinogen	
	Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure
	mg/kg-day			
Surface Soil				
Ingestion	1.5E-09	1.6E-08	1.2E-08	4.7E-08
Inhalation of particulates	1.29E-12	6.07E-12	1.23E-11	3.84E-11
Dermal	5.43E-01	3.54E+00	4.23E+00	1.03E+01
Sediment				
Ingestion	1.5E-09	1.6E-08	1.2E-08	4.7E-08
Dermal	5.43E-01	3.54E+00	4.23E+00	1.03E+01
Surface Water				
Ingestion	1.3E-07	6.7E-07	9.8E-07	2.0E-06
Dermal	2.17E-06	1.42E-05	1.69E-05	4.13E-05

NOTE:
Abbreviation: mg/kg-day = milligrams per kilogram per day.

Appendix B6. Critical Toxicity Data For Noncarcinogenic COPCs
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Contaminant	CAS Number	Chronic RfD [1]		Confidence in RfD	Endpoint
		Oral	Inhalation		
		mg/kg-day			
Antimony	7440-36-0	4.0E-04	NA	Low	longevity
Arsenic	7440-38-2	3.0E-04	3.0E-05	Medium	hyperpigmentation, vascular
Manganese	7439-96-5	1.4E-01	5.0E-05	Medium	CNS

NOTES:

Abbreviations: CAS = chemical abstracts scientific (registration), COPCs = chemical of potential concern, mg/kg-day = milligrams per kilograms per day, RfD = noncancer reference dose.

1 RfD value from EPA RBC Tables

Appendix B7. Critical Toxicity Data For Carcinogenic COPCs
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Contaminant	CAS Number	Slope Factor		Weight of Evidence Classification Ingestion/Inhalation	Type of Cancer Ingestion/Inhalation	Basis of Slope Factor Oral/Inhalation
		Oral	Inhalation			
		mg/kg/day-1				
Arsenic	7440-38-2	1.5E+00	1.5E+01	A	skin	epi studies

NOTE:

Abbreviations: A = known human carcinogen, CAS = chemical abstracts scientific (registration), COPCs = chemical of potential concern, mg/kg-day = milligrams per kilograms per day.

Appendix B8. Summary of Noncarcinogenic Hazards
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Route of Exposure	Chemicals of Potential Concern	Exposure Point Concentration		Average Daily Dose [1]		Critical Toxicity Dose	Hazard Quotient [2]	
		Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure		Central Tendency Exposure	Reasonable Maximum Exposure
Soil		**mg/kg**		**mg/kg-day**				
Ingestion	Antimony	2.06E+02	2.96E+02	1.01E-08	4.04E-08	4.00E-04	5.E-03	3.E-02
	Arsenic	1.39E+04	1.73E+04	1.01E-08	4.04E-08	3.00E-04	5.E-01	**2.E+00**
Inhalation of Particulates	Arsenic	1.39E+04	1.73E+04	1.23E-11	3.84E-11	3.00E-05	6.E-03	2.E-02
Dermal	Arsenic	1.39E+02	6.50E+02	4.23E-10	7.23E-09	3.00E-04	2.E-04	2.E-02
Sediments		**mg/kg**		**mg/kg-day**				
Ingestion	Arsenic	2.66E+02	5.08E+02	5.06E-09	2.02E-08	3.00E-04	4.E-03	3.E-02
Dermal	Arsenic	2.66E+00	1.91E+01	4.23E-10	7.23E-09	3.00E-04	4.E-06	5.E-04
Surface Water		**mg/L**		**mg/L-day**				
Ingestion	Arsenic	2.84E-01	1.44E+00	9.78E-07	1.96E-06	3.00E-04	9.E-04	9.E-03
	Manganese	1.72E-02	1.07E-01	9.78E-07	1.96E-06	1.40E-01	1.E-07	1.E-06
Dermal	Arsenic	2.84E-02	5.42E-02	1.69E-05	4.13E-05	3.00E-04	2.E-03	7.E-03
						Total HI [3]	**0.49**	**2.46**

NOTES:

Abbreviations: HI = Hazard Index, mg/kg = milligrams per kilogram, mg/kg-day = milligrams per kilogram per day, mg/L = milligrams per liter.

Bold = Unacceptable Noncarcinogenic Risk

1 Average Daily Dose = Exposure Point Concentration x Intake (Table B4).

2 Hazard quotient = Average Daily Dose / Oral Reference Dose (RfDo).

3 Hazard Index = sum of all Hazard Quotients.

Appendix B9. Summary of Carcinogenic Risks
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Route of Exposure	Chemicals of Potential Concern	Exposure Point Concentration		Average Daily Dose		Oral Slope Factor	Inhalation Slope Factor	Excess Cancer Risk [1]	
		Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure			Central Tendency Exposure	Reasonable Maximum Exposure
Soil		**mg/kg**		**mg/kg-day**					
Ingestion	Arsenic	1.39E+04	1.73E+04	9.09E-10	4.47E-09	1.5E+00	NA	**2.E-05**	**1.E-04**
Dermal	Arsenic	1.39E+04	1.73E+04	5.43E-11	2.48E-09	1.5E+00	NA	1.E-06	**6.E-05**
Inhalation of particulates	Arsenic	1.11E+02	5.20E+02	1.29E-12	6.07E-12	NA	1.5E+01	2.E-09	5.E-08
Sediments		**mg/kg**		**mg/kg-day**					
Ingestion	Arsenic	2.66E+02	5.59E+02	1.15E-09	2.24E-09	1.5E+00	NA	5.E-07	**2.E-06**
Dermal	Arsenic	2.66E+00	1.91E+01	5.43E-11	2.48E-09	1.5E+00	NA	2.E-10	7.E-08
Surface Water		**mg/L**		**mg/L-day**					
Ingestion	Arsenic	2.84E-01	1.44E+00	1.26E-07	6.71E-07	1.5E+00	NA	5.E-08	1.E-06
Dermal	Arsenic	2.84E-02	5.42E-02	2.17E-06	1.42E-05	1.5E+00	NA	9.E-08	1.E-06
							Total Excess Cancer Risk:	**2.E-05**	**2.E-04**

NOTES:

Abbreviations: mg/kg = milligrams per kilogram, mg/kg-day = milligrams per kilogram per day, mg/L = milligrams per liter.

Bold = Unacceptable Excess Cancer Risk

1 Excess Cancer Risk = Exposure Point Concentration x Average Daily Dose x Slope Factor (Sfo or Sfi).

Appendix B10. Preliminary Remediation Goal Screening - Near Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Media: Soil				Media: Subsurface soil				Media: Sediment				Media: Surface Water			
	Risk Based Screening Value**	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?	Preliminary Remediation Goal**	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?	Preliminary Remediation Goal**	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?	Preliminary Remediation Goal**	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?
	mg/kg	mg/kg			mg/kg	mg/kg			mg/kg	mg/kg			µg/L	µg/L		
Aluminum	9.9E+05		0.0E+00	no	9.9E+05		0.0E+00	no	9.9E+05		0.0E+00	no	3.7E+04		0.0E+00	no
Antimony	4.1E+02	3.89E+03	9.5E+00	**YES**	4.1E+02	3.89E+03	9.5E+00	**YES**	4.1E+02	1.3E+01	3.1E-02	no	1.5E+01	2.98E+00	2.0E-01	no
Arsenic	1.6E+00	1.96E+04	1.2E+04	**YES**	1.6E+00	1.96E+04	1.2E+04	**YES**	1.6E+00	2.9E+02	1.8E+02	**YES**	4.5E-02	2.12E+01	4.7E+02	**YES**
Barium	1.9E+05	7.45E+01	3.9E-04	no	1.9E+05	7.45E+01	3.9E-04	no	1.9E+05	9.8E+01	5.2E-04	no	7.3E+03	5.11E+00	7.0E-04	no
Beryllium	1.9E+03		0.0E+00	no	1.9E+03		0.0E+00	no	1.9E+03	2.3E-01	1.2E-04	no	7.3E+01		0.0E+00	no
Cadmium	8.1E+02	8.83E+00	1.1E-02	no	8.1E+02	8.83E+00	1.1E-02	no	8.1E+02	1.6E+00	2.0E-03	no	1.8E+01		0.0E+00	no
Chromium	1.4E+03	3.59E+01	2.6E-02	no	1.4E+03	3.59E+01	2.6E-02	no	1.4E+03	4.1E+01	2.9E-02	no	1.0E-03		0.0E+00	no
Cobalt	3.0E+02	2.12E+01	7.1E-02	no	3.0E+02	2.12E+01	7.1E-02	no	3.0E+02	1.0E+01	3.3E-02	no	1.1E+01		0.0E+00	no
Copper	4.1E+04	5.51E+02	1.3E-02	no	4.1E+04	5.51E+02	1.3E-02	no	4.1E+04	5.2E+01	1.3E-03	no	1.5E+03	1.53E+00	1.1E-03	no
Iron	7.2E+05	2.43E+05	3.4E-01	no	7.2E+05	2.43E+05	3.4E-01	no	7.2E+05		0.0E+00	no	2.6E+04	6.00E+01	2.3E-03	no
Lead	8.0E+02	9.28E+03	1.2E+01	**YES**	8.0E+02	9.28E+03	1.2E+01	**YES**	8.0E+02	7.6E+01	9.5E-02	no	NA	2.71E-01	NA	**YES**
Manganese	2.3E+04	4.82E+03	2.1E-01	no	2.3E+04	4.82E+03	2.1E-01	no	2.3E+04		0.0E+00	no	8.8E+02	4.33E+02	4.9E-01	no
Mercury	3.1E+02	2.03E+00	6.6E-03	no	3.1E+02	2.03E+00	6.6E-03	no	3.1E+02	4.6E+00	1.5E-02	no	3.1E+02	5.70E-02	1.8E-04	no
Nickel	2.0E+04	4.38E+01	2.2E-03	no	2.0E+04	4.38E+01	2.2E-03	no	2.0E+04		0.0E+00	no	2.0E+04	6.34E-01	3.2E-05	no
Selenium	5.1E+03	3.55E+00	6.9E-04	no	5.1E+03	3.55E+00	6.9E-04	no	5.1E+03		0.0E+00	no	1.8E+02		0.0E+00	no
Silver	5.1E+03	1.69E+02	3.3E-02	no	5.1E+03	7.79E+00	1.5E-03	no	5.1E+03	3.7E-01	7.2E-05	no	1.8E+02	5.00E+00	2.8E-02	no
Thallium	6.6E+01	3.97E+00	6.0E-02	no	6.6E+01	3.97E+00	6.0E-02	no	6.6E+01	2.8E-01	4.2E-03	no	6.6E+01		0.0E+00	no
Vanadium	5.2E+03	5.37E+01	1.0E-02	no	5.2E+03	5.37E+01	1.0E-02	no	5.2E+03	4.9E+01	9.5E-03	no	2.6E+02		0.0E+00	no
Zinc	3.1E+05	9.95E+02	3.2E-03	no	3.1E+05	9.95E+02	3.2E-03	no	3.1E+05	1.72E+02	5.6E-04	no	1.1E+04	5.09E+00	4.6E-04	no

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, mg/L = milligrams per liter, NA = not applicable, µg/L = micrograms per liter.
Shading = Not Applicable for this medium and/or chemical.

Appendix B11. Summary of Exposure Factors - Near Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Exposure Factors	Receptor				Source
	Child		Adult		
	Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure	
Body Weight (kg)	15	15	70	70	EPA, 1997
Exposure Frequency (d/yr) - soil	6	12	2	30	Site Specific
Exposure Frequency (d/yr) - sediment	6	12	2	30	Site Specific
Exposure Frequency (d/yr) - surface water	6	12	2	30	Site Specific
Event time (hours per event) - soil	1	2	6	8	Site Specific
Event time (bathing) hours per event	0.16	0.25	0.16	0.25	
Event Frequency (events/d)	1	1	1	1	Site Specific
Exposure Duration (yr)	6	6	9	24	EPA, 1997
Averaging Time (d)					
carcinogens	25,550	25,550	25,550	25,550	EPA, 1989
noncarcinogens	2,190	2,190	3,285	8,760	EPA, 1989
Intake Factors					
Ingestion of soil (mg/d)	100	200	50	100	EPA, 1997
Incidental ingestion of sediment (mg/d)	50	100	25	50	EPA, 1997
Ingetion surface water (L/d)	0.9	1.5	1.4	2.3	EPA, 1997
Exposed skin surface area (cm^2) - water	6,600	7,300	18,000	22,000	EPA, 2004a
Exposed skin surface area (cm^2) - soil	4,500	5,000	5,200	6,900	
Inhalation rate (m^3/d)	8.3	8.3	15.2	15.2	EPA, 1997
Dermal absorption factor					
volatile vp> 12000 Pa	0.0005	0.0005	0.0005	0.0005	EPA, 2004a
volatile vp< 12000 Pa	0.03	0.03	0.03	0.03	EPA, 2004a
inorganics	0.1	0.01	0.01	0.01	EPA, 2004a
DAw - Arsenic	0.002	0.002	0.002	0.002	
Rags Part E GI ABS					
Antimony (soil)	0.15	0.15	0.15	0.15	EPA, 2004a
Manganese (water)	0.04	0.04	0.04	0.04	EPA, 2004a
Soil Adherence Factor (mg/cm^2-event)	0.01	0.07	0.01	0.07	EPA, 2004a
PEF (mg^3/kg)	1.32E+09	1.32E+09	1.32E+09	1.32E+09	EPA, 2004a

NOTES:

Abbreviations: cm^2 = square centimeters, d = day, d/yr = days per year, kg = kilograms, L/hr = liters per hour, m^3/d = cubic meters per day, mg/cm^2 = milligrams per square centimeter, mg^3/kg = cubic milligrams per kilogram, mg/d = milligrams per day, Pa = Pascal, PEF = Particulate Emission Factor, vp = vapor pressure, yr = year.

SOURCES:

EPA, 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). EPA/540/1-89/002.
EPA, 1997. "Exposure Factors Handbook". Volumes I - III. EPA Office of Research and Development. August
EPA, 2004a. "Risk Assessment Guide for Superfund, Part E, Supplemental Guidance for Dermal Risk Assessment." July
EPA, 2004b. "Region IV Preliminary Remediation Goals". 2004 Update. EPA. December

Appendix B12. Noncarcinogenic Calculation of Dermal Intake - Near Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Dermal Contact with Soil and Sediment

Chemical of Interest	Dermal Absorption Factor	Conversion Factor	Adherence Factors		Dermal Absorption Values	
			Central Tendancy Exposure	Reasonable Maximum Exposure	Central Tendancy Exposure	Reasonable Maximum Exposure
	unitless	kg/mg	mg/cm^2 - event		mg/cm^2 - event	
Antimony	**Evaulation criteria not sufficiently established http://www.nj.gov/dep/srp/regs/rs/bb_ingest_dermal.pdf**					
Arsenic	0.01	0.000001	1.00E-02	7.00E-02	1.00E-10	7.00E-10
Manganese	Not a significant route of exposure http://www.inchem.org/documents/cicads/cicads/cicad12.htm					

NOTES:

Abbreviations: DA = Dermal Absorption, kg/mg = kilograms per miligram, mg/cm^2 = milligrams per cubic centimeter, Kp = chemical-specific dermal permeability coefficient from water, cm^2/hr = square centimeters/hour

Appendix B13. Carcinogenic Calculation of Dermal Intake - Near Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Dermal Contact with Soil and Sediment

Chemical of Interest	Dermal Absorption Factor	Conversion Factor	Adherence Factors		Dermal Absorption Values	
			Central Tendancy Exposure	Reasonable Maximum Exposure	Central Tendancy Exposure	Reasonable Maximum Exposure
	unitless	kg/mg	mg/cm^2 - event		mg/cm^2 - event	
Arsenic	0.01	0.000001	1.00E-02	7.00E-02	1.00E-10	7.00E-10

NOTES:

Abbreviations: DA = Dermal Absorption, kg/mg = kilograms per miligram, mg/cm^2 = milligrams per cubic centimeter, Kp = chemical-specific dermal permeability coefficient from water, cm^2/hr = square centimeters/hour

Appendix B14. Intake Calculations - Near Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Exposure Routes (Recreational)	Carcinogen		Noncarcinogen	
	Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure
	mg/kg-day			
Surface Soil				
Ingestion	3.3E-09	1.2E-07	9.8E-10	3.9E-08
Inhalation of particulates	2.90E-14	1.55E-12	2.25E-13	4.51E-12
Dermal	1.58E-09	3.10E-07	4.07E-09	5.67E-07
Sediment				
Ingestion	6.3E-11	6.7E-09	4.9E-10	2.0E-08
Dermal	1.65E-09	6.21E-08	4.07E-09	5.67E-07
Surface Water				
Ingestion	3.1E-05	1.2E-03	1.1E-04	3.3E-03
Dermal	2.14E-08	1.68E-06	9.64E-08	3.33E-07

NOTE:
Abbreviation: mg/kg-day = milligrams per kilogram per day.

Appendix B15. Critical Toxicity Data for Noncarcinogenic COPCs - Near Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Contaminant	CAS Number	Chronic RfD [1]		Confidence in RfD	Endpoint
		Oral	Inhalation		
		mg/kg-day			
Antimony	7440-36-0	4.0E-04	NA	Low	longevity
Arsenic	7440-38-2	3.0E-04	3.0E-05	Medium	hyperpigmentation, vascular

NOTES:

Abbreviations: CAS = chemical abstracts scientific (registration), COPCs = chemical of potential concern, mg/kg-day = milligrams per kilograms per day, RfD = noncancer reference dose.

1 RfD value from EPA RBC Tables

Appendix B16. Critical Toxicity Data for Carcinogenic COPCs - Near Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Contaminant	CAS Number	Slope Factor		Weight of Evidence Classification Ingestion/Inhalation	Type of Cancer Ingestion/Inhalation	Basis of Slope Factor Oral/Inhalation
		Oral	Inhalation			
		mg/kg/day-1				
Arsenic	7440-38-2	1.5E+00	1.5E+01	A	skin	epi studies

NOTE:

Abbreviations: A = known human carcinogen, CAS = chemical abstracts scientific (registration), COPCs = chemical of potential concern, mg/kg-day = milligrams per kilograms per day.

Appendix B17. Summary of Noncarcinogenic Hazards - Near Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Route of Exposure	Chemicals of Potential Concern	Exposure Point Concentration		Average Daily Dose [1]		Critical Toxicity Dose	Hazard Quotient [2]	
		Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure		Central Tendency Exposure	Reasonable Maximum Exposure
Soil		**mg/kg**		**mg/kg-day**				
Ingestion	Antimony	2.72E+02	4.37E+02	9.78E-10	3.91E-08	4.00E-04	6.6.E-04	4.3.E-02
	Arsenic	1.57E+04	2.16E+04	9.78E-10	3.91E-08	3.00E-04	5.1.E-02	**2.8.E+00**
Inhalation of Particulates	Arsenic	1.57E+04	2.16E+04	2.25E-13	4.51E-12	3.00E-05	1.2.E-04	3.2.E-03
Dermal	Arsenic	1.57E+02	8.08E+02	4.07E-19	3.97E-16	3.00E-04	2.1.E-13	1.1.E-09
Sediments		**mg/kg**		**mg/kg-day**				
Ingestion	Arsenic	2.67E+02	5.35E+02	4.89E-10	1.96E-08	3.00E-04	4.4.E-04	3.5.E-02
Dermal	Arsenic	3.34E+02	6.68E+02	4.07E-19	3.97E-16	3.00E-04	4.5.E-13	8.8.E-10
Surface Water		**mg/L**		**mg/L-day**				
Ingestion	Arsenic	9.19E-03	1.33E-02	1.10E-04	3.29E-03	3.00E-04	3.4.E-03	1.5.E-01
Dermal	Arsenic	9.19E-05	1.33E-04	9.64E-08	3.33E-07	3.00E-04	3.0.E-08	1.5.E-07
						Total HI [3]	**0.1**	**3.0**

NOTES:

Abbreviations: HI = Hazard Index, mg/kg = milligrams per kilogram, mg/kg-day = milligrams per kilogram per day, mg/L = milligrams per liter.

Bold = Unacceptable Noncarcinogenic Risk

1 Average Daily Dose = Exposure Point Concentration x Intake (Table B13).

2 Hazard quotient = Average Daily Dose / Oral Reference Dose (RfDo).

3 Hazard Index = sum of all Hazard Quotients.

Appendix B18. Summary of Carcinogenic Risks - Near Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Route of Exposure	Chemicals of Potential Concern	Exposure Point Concentration		Average Daily Dose		Oral Slope Factor	Inhalation Slope Factor	Excess Cancer Risk [1]	
		Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure			Central Tendency Exposure	Reasonable Maximum Exposure
Soil		**mg/kg**		**mg/kg-day**					
Ingestion	Arsenic	1.57E+04	2.16E+04	3.30E-09	1.24E-07	1.5E+00	NA	**7.8.E-05**	**4.0.E-03**
Dermal	Arsenic	1.57E+02	8.08E+02	4.07E-19	2.17E-16	1.5E+00	NA	9.6.E-17	2.6.E-13
Inhalation of particulates	Arsenic	1.57E+04	2.16E+04	2.90E-14	1.55E-12	NA	1.5E+01	6.8.E-09	5.0.E-07
Sediments		**mg/kg**		**mg/kg-day**					
Ingestion	Arsenic	2.67E+02	5.35E+02	6.29E-11	6.71E-09	1.5E+00	NA	2.5.E-08	**5.4.E-06**
Dermal	Arsenic	2.67E+00	2.01E+01	1.65E-19	4.34E-17	1.5E+00	NA	6.6.E-19	1.3.E-15
Surface Water		**mg/L**		**mg/L-day**					
Ingestion	Arsenic	9.19E-03	1.33E-02	3.12E-05	1.16E-03	1.5E+00	NA	4.3.E-07	**2.3.E-05**
Dermal	Arsenic	9.19E-05	1.33E-04	2.14E-08	1.68E-06	1.5E+00	NA	2.9.E-12	3.4.E-10
							Total Excess Cancer Risk:	**7.8.E-05**	**4.0.E-03**

NOTES:

Abbreviations: mg/kg = milligrams per kilogram, mg/kg-day = milligrams per kilogram per day, mg/L = milligrams per liter.

Bold = Unacceptable Excess Cancer Risk

1 Excess Cancer Risk = Exposure Point Concentration x Average Daily Dose x Slope Factor (Sfo or Sfi).

Appendix B19. Preliminary Remediation Goal Screening - Remote From Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest	Media: Soil				Media: Subsurface soil				Media: Sediment				Media: Surface Water			
	Risk Based Screening Value	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?	Preliminary Remediation Goal**	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?	Preliminary Remediation Goal**	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?	Preliminary Remediation Goal**	Exposure Point Concentration	Risk Ratio (Ri)	Chemical of Potential Concern?
	mg/kg	mg/kg			mg/kg	mg/kg			mg/kg	mg/kg			µg/L	µg/L		
Aluminum	9.9E+05		0.0E+00	no	9.9E+05		0.0E+00	no	9.9E+05		0.0E+00	no	3.7E+04		0.0E+00	no
Antimony	4.1E+02	3.89E+03	9.5E+00	**YES**	4.1E+02	3.89E+03	9.5E+00	**YES**	4.1E+02	1.3E+01	3.1E-02	no	1.5E+01	4.90E+00	3.3E-01	no
Arsenic	1.6E+00	1.96E+04	1.2E+04	**YES**	1.6E+00	1.96E+04	1.2E+04	**YES**	1.6E+00	2.9E+02	1.8E+02	**YES**	4.5E-02	2.51E+03	5.6E+04	**YES**
Barium	1.9E+05	7.45E+01	3.9E-04	no	1.9E+05	7.45E+01	3.9E-04	no	1.9E+05	9.8E+01	5.2E-04	no	7.3E+03	8.50E+00	1.2E-03	no
Beryllium	1.9E+03		0.0E+00	no	1.9E+03		0.0E+00	no	1.9E+03	2.3E-01	1.2E-04	no	7.3E+01	2.00E+00	2.7E-02	no
Cadmium	8.1E+02	8.83E+00	1.1E-02	no	8.1E+02	8.83E+00	1.1E-02	no	8.1E+02	1.6E+00	2.0E-03	no	1.8E+01	7.70E+00	4.3E-01	no
Chromium	1.4E+03	3.59E+01	2.6E-02	no	1.4E+03	3.59E+01	2.6E-02	no	1.4E+03	4.1E+01	2.9E-02	no	1.0E-03		0.0E+00	no
Cobalt	3.0E+02	2.12E+01	7.1E-02	no	3.0E+02	2.12E+01	7.1E-02	no	3.0E+02	1.0E+01	3.3E-02	no	1.1E+01		0.0E+00	no
Copper	4.1E+04	5.51E+02	1.3E-02	no	4.1E+04	5.51E+02	1.3E-02	no	4.1E+04	5.2E+01	1.3E-03	no	1.5E+03	2.14E+02	1.5E-01	no
Iron	7.2E+05	2.43E+05	3.4E-01	no	7.2E+05	2.43E+05	3.4E-01	no	7.2E+05		0.0E+00	no	2.6E+04	2.29E+04	8.8E-01	no
Lead	8.0E+02	9.28E+03	1.2E+01	**YES**	8.0E+02	9.28E+03	1.2E+01	**YES**	8.0E+02	7.6E+01	9.5E-02	no	NA	5.92E+01	NA	**YES**
Manganese	2.3E+04	4.82E+03	2.1E-01	no	2.3E+04	4.82E+03	2.1E-01	no	2.3E+04		0.0E+00	no	8.8E+02	5.22E+02	5.9E-01	no
Mercury	3.1E+02	2.03E+00	6.6E-03	no	3.1E+02	2.03E+00	6.6E-03	no	3.1E+02	4.6E+00	1.5E-02	no	3.1E+02	6.09E-01	2.0E-03	no
Nickel	2.0E+04	4.38E+01	2.2E-03	no	2.0E+04	4.38E+01	2.2E-03	no	2.0E+04		0.0E+00	no	2.0E+04	5.10E-01	2.6E-05	no
Selenium	5.1E+03	3.55E+00	6.9E-04	no	5.1E+03	3.55E+00	6.9E-04	no	5.1E+03		0.0E+00	no	1.8E+02	3.00E-01	1.7E-03	no
Silver	5.1E+03	1.69E+02	3.3E-02	no	5.1E+03	7.79E+00	1.5E-03	no	5.1E+03	3.7E-01	7.2E-05	no	1.8E+02	3.82E+00	2.1E-02	no
Thallium	6.6E+01	3.97E+00	6.0E-02	no	6.6E+01	3.97E+00	6.0E-02	no	6.6E+01	2.8E-01	4.2E-03	no	6.6E+01		0.0E+00	no
Vanadium	5.2E+03	5.37E+01	1.0E-02	no	5.2E+03	5.37E+01	1.0E-02	no	5.2E+03	4.9E+01	9.5E-03	no	2.6E+02		0.0E+00	no
Zinc	3.1E+05	9.95E+02	3.2E-03	no	3.1E+05	9.95E+02	3.2E-03	no	3.1E+05	1.72E+02	5.6E-04	no	1.1E+04	6.39E+02	5.8E-02	no

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, mg/L = milligrams per liter, NA = not applicable, µg/L = micrograms per liter.
Shading = Not Applicable for this medium and/or chemical.

Appendix B20. Summary of Exposure Factors - Remote From Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Exposure Factors	Receptor				Source
	Child		Adult		
	Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure	
Body Weight (kg)	15	15	70	70	EPA, 1997
Exposure Frequency (d/yr) - soil	6	12	2	12	Site Specific
Exposure Frequency (d/yr) - sediment	6	12	2	12	Site Specific
Exposure Frequency (d/yr) - surface water	6	12	2	12	Site Specific
Event time -bathing (hours per event)			0.16	0.25	
Event time (hours per event) - soil	1	2	1	2	Site Specific
Event Frequency (events per day)	1	1	1	1	Site Specific
Exposure Duration (yr)	6	6	9	15	EPA, 1997
Averaging Time (d) [1]					
carcinogens	25,550	25,550	25,550	25,550	EPA, 1989
noncarcinogens	2,190	2,190	3,285	8,760	EPA, 1989
Intake Factors					
Ingestion of soil (mg/d)	100	200	50	100	EPA, 1997
Incidental ingestion of sediment (mg/d)	50	100	25	50	EPA, 1997
Ingestion of surface water ingestion (L/d)	0.05	0.05	1.4	2.3	EPA, 1997
Exposed skin surface area (cm^2) - water	6600	7300	18000	22000	EPA, 2004a
Exposed skin surface area (cm^2) - soil	4500	5000	5200	6900	
Inhalation rate (m^3/d)	8	8	15	15	EPA, 1997
Dermal absorption factor					
volatile vp> 12000 Pa	0.0005	0.0005	0.0005	0.0005	EPA, 2004a
volatile vp< 12000 Pa	0.03	0.03	0.03	0.03	EPA, 2004a
inorganics	0.1	0.01	0.01	0.01	EPA, 2004a
DAw -Arsenic	0.002	0.002	0.002	0.002	
Rags Part E GI ABS					
Antimony (soil)	0.15	0.15	0.15	0.15	EPA, 2004a
Manganese (water)	0.04	0.04	0.04	0.04	EPA, 2004a
Soil Adherence Factor (mg/cm^2-event)	0.01	0.07	0.01	0.07	EPA, 2004a
PEF (mg^3/kg)	1.32E+09	1.32E+09	1.32E+09	1.32E+09	EPA, 2004a

NOTES:

Abbreviations: cm^2 = square centimeters, d = day, d/yr = days per year, kg = kilograms, L/hr = liters per hour, m^3/d = cubic meters per day, mg/cm^2 = milligrams per square centimeter, mg^3/kg = cubic milligrams per kilogram, mg/d = milligrams per day, Pa = Pascal, PEF = Particulate Emission Factor, vp = vapor pressure, yr = year.

1 Averaging Time = Exposure Duration (yrs) X 365 days per year.

SOURCES:

EPA, 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). EPA/540/1-89/002.

EPA, 1997. "Exposure Factors Handbook". Volumes I - III. EPA Office of Research and Development. August

EPA, 2004a. "Risk Assessment Guide for Superfund, Part E, Supplemental Guidance for Dermal Risk Assessment." July

EPA, 2004b. "Region IV Preliminary Remediation Goals". 2004 Update. EPA. December

Appendix B21. Noncarcinogenic Calculation of Dermal Intake - Remote From Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Dermal Contact with Soil and Sediment

Chemical of Interest	Dermal Absorption Factor	Conversion Factor	Adherence Factors		Dermal Absorption Values	
			Central Tendancy Exposure	Reasonable Maximum Exposure	Central Tendancy Exposure	Reasonable Maximum Exposure
	unitless	kg/mg	mg/cm^2 - event		mg/cm^2 - event	
Antimony	Evaulation criteria not sufficiently established http://www.nj.gov/dep/srp/regs/rs/bb_ingest_dermal.pdf					
Arsenic	0.01	0.000001	1.00E-02	7.00E-02	1.00E-10	7.00E-10
Manganese	Not a significant route of exposure http://www.inchem.org/documents/cicads/cicads/cicad12.htm					

Dermal Contact with Surface Water

Chemical of Interest	Kp (cm^2/hr)	Conversion Factor (kg/mg)	t event	DA water
Arsenic	0.002	0.001	2	0.000004

NOTES:

Abbreviations: DA = Dermal Absorption, kg/mg = kilograms per miligram, mg/cm^2 = milligrams per cubic centimeter, Kp = chemical-specific dermal permeability coefficient from water, cm^2/hr = square centimeters/hour

Appendix B22. Carcinogenic Calculation of Dermal Intake - Remote From Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Dermal Contact with Soil and Sediment

Chemical of Interest	Dermal Absorption Factor	Conversion Factor	Adherence Factors		Dermal Absorption Values	
			Central Tendancy Exposure	Reasonable Maximum Exposure	Central Tendancy Exposure	Reasonable Maximum Exposure
	unitless	kg/mg	mg/cm^2 - event		mg/cm^2 - event	
Arsenic	0.01	0.000001	1.00E-02	7.00E-02	1.00E-10	7.00E-10

Dermal Contact with Surface Water

Chemical of Interest	Kp	Conversion Factor (kg/mg)	t event	DA water
Arsenic	0.002	0.001	2	0.000004

NOTES:

Abbreviations: DA = Dermal Absorption, kg/mg = kilograms per miligram, mg/cm^2 = milligrams per cubic centimeter, Kp = chemical-specific dermal permeability coefficient from water, cm^2/hr = square centimeters/hour

Appendix B23. Intake Calculations - Remote From Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Exposure Routes (Recreational)	Carcinogen		Noncarcinogen	
	Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure
	mg/kg-day			
Surface Soil				
Ingestion	2.1E-11	8.4E-10	1.6E-10	2.4E-09
Inhalation of particulates	4.83E-15	9.66E-14	3.76E-14	2.82E-13
Dermal	7.55E-13	1.29E-10	5.87E-12	3.77E-10
Sediment				
Ingestion	1.0E-11	4.2E-10	8.2E-11	1.2E-09
Dermal	1.21E-13	1.61E-11	9.39E-13	4.71E-11
Surface Water				
Ingestion	1.4E-05	2.3E-04	1.1E-04	6.8E-04
Dermal	4.83E-09	9.23E-08	3.76E-08	2.69E-07

NOTE:
Abbreviation: mg/kg-day = milligrams per kilogram per day.

Appendix B24. Critical Toxicity Data for Noncarcinogenic COPCs - Remote From Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Contaminant	CAS Number	Chronic RfD [1]		Confidence in RfD	Endpoint
		Oral	Inhalation		
		mg/kg-day			
Antimony	7440-36-0	4.0E-04		Low	longevity
Arsenic	7440-38-2	3.0E-04	3.0E-05	Medium	hyperpigmentation, vascular

NOTES:

Abbreviations: CAS = chemical abstracts scientific (registration), COPCs = chemical of potential concern, mg/kg-day = milligrams per kilograms per day, RfD = noncancer reference dose.

1 RfD value from EPA RBC Tables

Appendix B25. Critical Toxicity Data for Carcinogenic COPCs - Remote From Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Contaminant	CAS Number	Slope Factor		Weight of Evidence Classification Ingestion/Inhalation	Type of Cancer Ingestion/Inhalation	Basis of Slope Factor Oral/Inhalation
		Oral	Inhalation			
		mg/kg/day-1				
Arsenic	7440-38-2	1.5E+00	1.5E+01	A	skin	epi studies

NOTE:

Abbreviations: A = known human carcinogen, CAS = chemical abstracts scientific (registration), COPCs = chemical of potential concern, mg/kg-day = milligrams per kilograms per day

Appendix B26. Summary of Noncarcinogenic Hazards - Remote From Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Route of Exposure	Chemicals of Potential Concern	Exposure Point Concentration		Average Daily Dose [1]		Critical Toxicity Dose	Hazard Quotient [2]	
		Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure		Central Tendency Exposure	Reasonable Maximum Exposure
Soil		**mg/kg**		**mg/kg-day**				
Ingestion	Antimony	1.08E+02	5.83E+02	1.63E-10	2.45E-09	4.00E-04	4.4.E-05	3.6.E-03
	Arsenic	1.15E+04	1.58E+04	1.63E-10	2.45E-09	3.00E-04	6.2.E-03	1.3.E-01
Inhalation of Particulates	Arsenic	1.15E+04	1.58E+04	3.76E-14	2.82E-13	3.00E-05	1.4.E-05	1.5.E-04
Dermal	Arsenic	1.15E+02	5.93E+02	5.87E-12	3.77E-10	3.00E-04	2.2.E-06	7.4.E-04
Sediments		**mg/kg**		**mg/kg-day**				
Ingestion	Arsenic	2.66E+02	5.08E+02	8.15E-11	1.22E-09	3.00E-04	7.2.E-05	2.1.E-03
Dermal	Arsenic	2.66E+00	1.91E+01	9.39E-13	4.71E-11	3.00E-04	8.3.E-09	3.0.E-06
Surface Water		**mg/L**		**mg/L-day**				
Ingestion	Arsenic	5.44E-01	2.06E+00	1.10E-04	6.75E-04	3.00E-04	2.0.E-01	**4.6.E+00**
Dermal	Arsenic	5.44E-03	2.06E-02	3.76E-08	2.69E-07	3.00E-04	6.8.E-07	1.8.E-05
						Total HI [3]	**0.2**	**4.8**

NOTES:

Abbreviations: HI = Hazard Index, mg/kg = milligrams per kilogram, mg/kg-day = milligrams per kilogram per day, mg/L = milligrams per liter.

1 Average Daily Dose = Exposure Point Concentration x Intake (Table B22).

2 Hazard quotient = Average Daily Dose / Oral Reference Dose (RfDo).

3 Hazard Index = sum of all Hazard Quotients.

Appendix B27. Summary of Carcinogenic Risks - Remote From Townsite Samples
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Route of Exposure	Chemicals of Potential Concern	Exposure Point Concentration		Average Daily Dose		Oral Slope Factor	Inhalation Slope Factor	Excess Cancer Risk [1]	
		Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure			Central Tendency Exposure	Reasonable Maximum Exposure
Soil		**mg/kg**		**mg/kg-day**					
Ingestion	Arsenic	1.15E+04	1.58E+04	9.09E-10	4.47E-09	1.5E+00	NA	**1.6.E-05**	**1.1.E-04**
Dermal	Arsenic	1.15E+02	5.93E+02	5.43E-11	2.48E-09	1.5E+00	NA	9.4.E-09	**2.2.E-06**
Inhalation of particulates	Arsenic	1.15E+04	1.58E+04	1.29E-12	6.07E-12	NA	1.5E+01	2.2.E-07	**1.4.E-06**
Sediments		**mg/kg**		**mg/kg-day**					
Ingestion	Arsenic	2.66E+02	5.08E+02	1.15E-09	2.24E-09	1.5E+00	NA	4.6.E-07	**1.7.E-06**
Dermal	Arsenic	2.66E+00	1.91E+01	5.43E-11	2.48E-09	1.5E+00	NA	2.2.E-10	7.1.E-08
Surface Water		**mg/L**		**mg/L-day**					
Ingestion	Arsenic	5.44E-01	2.06E+00	1.41E-05	2.31E-04	1.5E+00		**1.2.E-05**	**7.1.E-04**
Dermal	Arsenic	5.44E-03	2.06E-02	4.83E-09	9.23E-08	1.5E+00		3.9.E-11	2.8.E-09
							Total Excess Cancer Risk:	**2.8.E-05**	**8.3.E-04**

NOTES:

Abbreviations: mg/kg = milligrams per kilogram, mg/kg-day = milligrams per kilogram per day, mg/L = milligrams per liter.

Bold = Unacceptable Excess Cancer Risk, NA = Not Applicable

1 Excess Cancer Risk = Exposure Point Concentration x Average Daily Dose x Slope Factor (Sfo or Sfi).

Appendix C.

Terrestrial Ecological Evaluation

Voluntary Cleanup Program

Washington State Department of Ecology – Toxics Cleanup Program

TERRESTRIAL ECOLOGICAL EVALUATION EXCLUSION

Some contaminated sites are excluded from conducting a Terrestrial Ecological Evaluation (TEE). If your site meets the criteria for exclusion as described in WAC 173-340-7491, please complete this form.

Please note that exclusion from the TEE does not exclude the site for consideration of effects on aquatic or sediment ecological receptors.

SITE NAME: Monte-Cristo Mining Site

SITE ADDRESS: Mt. Baker-Snoqualmie National Forest near Verlot, Washington

EVALUATOR'S NAME: RONE BREWER, SOUND ECOLOGICAL ENDEAVORS

REASONS FOR EXCLUSION:

A site is eligible for exclusion if it meets any of the following criteria:

1. POINT OF COMPLIANCE WAC 173-340-7491(1)(A)

- No contamination present at site.
  1-☐
- All contamination is below 15 feet prior to remedial activities.
  2-☐
- All contamination is below six feet and an institutional control has been implemented, as required by WAC 173-340-440 .
  3-☐
- All contamination is below a site-specific point of compliance established in compliance with WAC 173-340-7490(4)(b) with an institutional control implemented as required by WAC 173-340-440.
  4-☐
  Please provide documentation that describes the rational for setting a site-specific point of compliance.

2. BARRIERS TO EXPOSURE WAC 173-340-7491(1)(B)

- All contaminated soil is or will be covered by physical barriers that prevent exposure to plants and wildlife and an institutional control has been implemented, as required by WAC 173-340-440.
  5-☐
  An exclusion based on future land use must have a completion date for future development that is acceptable to Ecology.

3. Undeveloped land WAC 173-340-7491 (1)(c)

- There is less than one-quarter acre of contiguous undeveloped land on or within 500 feet of any area of the site and any of the following chemicals is present: chlorinated dioxins or furans, PCB mixtures, DDT, DDE, DDD, aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, heptachlor epoxide, benzene hexachloride, toxaphene, hexachlorobenzene, pentachlorophenol, or pentachlorobenzene.
  6-☐
- For sites not containing any of the chemicals mentioned above, there is less than one-and-a-half acres of contiguous undeveloped land on or within 500 feet of any area of the site.
  7-☐

"Undeveloped land" is land that is not covered by building, roads, paved areas, or other barriers that would prevent wildlife from feeding on plants, earthworms, insects, or other food in or on the soil.

"Contiguous" undeveloped land is an area of undeveloped land that is not divided into smaller areas of highways, extensive paving, or similar structures that are likely to reduce the potential use of the overall area by wildlife.

4. Background concentrations WAC 173-340-7491 (1) (d)

- Concentrations of hazardous substances in soil do not exceed background levels as described in WAC 173-340-709.

8-☐

Explanation of Exclusion (If required):

Exclusion not possible. Simplified terrestrial ecological evaluation not allowed.

Conditions warrant site-specific ecological assessment

If your site does not meet the TEE exclusions, you may have to conduct a simplified TEE in accordance with WAC 173-340-7492 or a site-specific TEE in accordance with WAC 173-340-7493. Please contact regional VCP staff with questions about conducting a simplified or site-specific TEE.

Ecology is an equal opportunity employer. For alternative format, please contact the Toxic Cleanup Program at (360) 407-7170 or 711 or 1-800-833-6388 (TTY).

Appendix D.

Rare, Threatened, and Endangered Species

WASHINGTON STATE DEPARTMENT OF
Natural Resources

DOUG SUTHERLAND
Commissioner of Public Lands

MAY 31 2005

May 24, 2005

Ryan Tobias
Cascade Earth Sciences
7150 Supra Drive SW
Albany OR 97321

SUBJECT: Monte Cristo Mine – Abandoned Mine Lands Site Inspection (T29N R11E S21,22)

We've searched the Natural Heritage Information System for information on rare plants and high quality native wetland and terrestrial ecosystems in the vicinity of your project. A summary of this information is enclosed. In your planning, please consider protection of these significant natural features. Please contact us for consultation on projects that may have an effect on these rare species or high quality ecosystems.

The information provided by the Washington Natural Heritage Program is based solely on existing information in the database. There may be significant natural features in your study area of which we are not aware. These data are being provided to you for informational and planning purposes only - the Natural Heritage Program has no regulatory authority. This information is for your use only for environmental assessment and is not to be redistributed. Others interested in this information should be directed to contact the Natural Heritage Program.

The Washington Natural Heritage Program is responsible for information on the state's rare plants as well as high quality ecosystems. For information on animal species of concern, please contact Priority Habitats and Species, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia WA 98501-1091, or by phone (360) 902-2543.

Please visit our internet website at http://www.dnr.wa.gov/nhp for more information. Lists of rare plants and their status, rare plant fact sheets, as well as rare plant survey guidelines are available for download from the site. Please call me at (360) 902-1667 if you have any questions.

Sincerely,

Sandy Swope Moody

Sandy Swope Moody, Environmental Review Coordinator
Washington Natural Heritage Program

Enclosures

Asset Management & Protection Division, PO Box 47014, Olympia WA 98504-7014
FAX 360-902-1789

WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
ENDANGERED, THREATENED AND SENSITIVE PLANT SPECIES &
HIGH QUALITY WETLAND ECOSYSTEMS AND HIGH QUALITY TERRESTRIAL ECOSYSTEMS
IN THE VICINITY OF MONTE CRISTO MINE, SNOHOMISH COUNTY WA
REQUESTED BY CASCADE EARTH SCIENCES

Data Current as of May 2005

TOWNSHIP, RANGE AND SECTION	ELEMENT NAME	STATE STATUS	FEDERAL STATUS
T29N R11E S28 N2 S33 NE	*Platanthera chorisiana* (Choris' bog-orchid)	T	

WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
Rare Plant Species

FEDERAL STATUS DEFINITIONS- (Note: Federally listed plant species are subject to the US Endangered Species Act.)

LE = Listed Endangered: Any taxon that is in danger of extinction throughout all or a significant portion of its range and that has been formally listed as such in the Federal Register under the Federal Endangered Species Act.

LT = Listed Threatened: Any taxon that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been formally listed as such in the Federal Register under the Federal Endangered Species Act.

PE = Proposed Endangered: Any taxon that is in danger of extinction throughout all or a significant portion of its range and that has been proposed for listing as such in the Federal Register under the Federal Endangered Species Act.

PT = Proposed Threatened: Any taxon that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been proposed for listing as such in the Federal Register under the Federal Endangered Species Act.

C = Candidate species: Taxa for which current information indicates the probable appropriateness of listing as Endangered or Threatened and that has been published in the Federal Register as a candidate for listing under the Federal Endangered Species Act.

SC = Species of Concern: Species whose conservation standing is of concern but for which status information is still needed. Species of concern lists are not published in the Federal Register.

STATE STATUS DEFINITIONS- (Note: The state ESA does not include provisions to list or protect rare plant species – the state rare plant list is advisory only.)

E = Endangered: Any taxon in danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree.

T = Threatened: Any taxon likely to become Endangered in Washington within the foreseeable future if factors contributing to its population decline or habitat degradation or loss continue.

S = Sensitive: Any taxon that is vulnerable or declining and could become Endangered or Threatened in the state without active management or removal of threats.

X = Possibly Extinct or Extirpated from Washington: Based on recent field searches, a number of plant taxa are considered to be possibly extinct or extirpated from Washington. Taxa in this group are all high priorities for field investigations. If found, they will be assigned one of the above status categories.

R = Review: Taxa of potential concern, but for which no status has yet been assigned.
Group 1 = Taxa in need of additional field work before a status can be assigned.
Group 2 = Taxa with unresolved taxonomic questions.

W = Watch: Taxa more abundant and/or less threatened in Washington than previously assumed.

Non-Vascular Plant:

P = Priority: At this time, there is insufficient information to assign a statewide status to most of the non-vascular taxa. For now, the lichen and macrofungi lists have been divided into two priority groups based on criteria of occurrence pattern, vulnerability, threats, degree of protection, and taxonomy.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE - HABITATS AND SPECIES REPORT
IN THE VICINITY OF T29R11E SECTION 21
Report Date: May 09, 2005

Information About Priority Habitats and Species Polygons

Priority Habitats and Species (PHS) polygons are labeled with a unique number and "+" symbol, roughly in the center of the polygon on the map. This PHS Poly number refers to a list of form numbers and species and habitat codes contained in the PHS Polygon Cross Reference Report (listed below). The form numbers refer to the attached PHS Polygon Report. This report details each species or habitat depicted as a polygon on the map. For a complete description of the codes used in this report please refer to the Fish and Wildlife Map Products document. This document may be viewed on our web site at http://www.wdfw.wa.gov/hab/release.htm.

Priority Habitats and Species Polygon - Summary Habitat and Species List:

This report and the accompanying maps may contain some species or habitats that are not considered priority by the agency. YES under the "PHS" column in the table below indicates that the species is considered a priority and is on the Priority Habitats and Species List and/or the Species of Concern List. NO under the "PHS" column indicates the species/habitat is not considered an agency priority.

PHS	State Status	PHS Code	Common Name	Species Use	Species Use Description
YES		HIHI	HARLEQUIN DUCK	B	BREEDING OCCURRENCE

Priority Habitats and Species Polygon Cross Reference Report:

Form number 900000 indicates presence of PHS is unknown or the area was not mapped. Form numbers 909998, 909997, or 909996 indicate compilation errors.

PHS Poly#	Form#	PHS Code*Species Use
2	900000	*-
3	901486	HIHI*B-

Information About Wildlife Heritage Point Report

Wildlife Heritage points on the map can be referenced to this report by noting the quadpt number where the point occurs on the map, and then looking up the information listed below. This report is sorted by the quadpt number and provides details on each species depicted on the map. For a complete description of the codes used in this report, please refer to the Fish and Wildlife Map Products document. This document may be viewed on our web site at http://www.wdfw.wa.gov/hab/release.htm.

Wildlife Heritage Point - Summary Species List:

This report and the accompanying maps may contain some species or habitats that are not considered priority by the agency. YES under the "PHS" column in the table below indicates that the species is considered a priority and is on the Priority Habitats and Species List and/or the Species of Concern List. NO under the "PHS" column indicates the species/habitat is not considered an agency priority.

PHS	State Status	Species Code	Common Name	Species Use	Species Use Description
NO	SM	ASTR	TAILED FROG	IO	INDIVIDUAL OCCURRENCE

Wildlife Heritage Point Report:

Quadpt#: 4712184010 Species Code: ASTR Species Use: IO Common Name: TAILED FROG
Year: 1992 Class: SA Accuracy: C Scientific Name: ASCAPHUS TRUEI
State Status: SM Federal Status: FCo Priority: NO WDFW Region: 4 Verified: V
Township - Range - Section: T29N R11E S21 Occurrence#: 85 Sequence#: 1
General Description: TAILED FROG. S FORK SAUK R, 1/2 MI DOWNSTREAM OF GLACIER CRK., 2 TADPOLES.

Quadpt#: 4712184012 Species Code: ASTR Species Use: IO Common Name: TAILED FROG
Year: 1994 Class: SA Accuracy: C Scientific Name: ASCAPHUS TRUEI
State Status: SM Federal Status: FCo Priority: NO WDFW Region: 4 Verified: V
Township - Range - Section: T29N R11E S21 Occurrence#: 335 Sequence#: 1
General Description: BASE OF SUNDAY FALLS, JUST SOUTH OF MONTE CRISTO. 2 TAILED FROGS SEEN.

HERP RECORD #: 310506

Codes Used In Wildlife Heritage Point Report

Quadpt# : A sequential number for a point based on a US Geological Survey 7.5-minute quadrangle.

Species Code : Alphanumeric code which identifies the species. List of codes are available in the documentation.

Species Use : Criteria that identifies how the area is used by the indicated species. List of codes are available in the documentation.

Common Name : Common name of the species.

Year : Year of the observation.

Class : Code that separates animals into general groups.
AA = Artifical animal (e.g., nest platforms not used yet).
EA = Exotic animal.
GA = Game animal.
NA = No animal found after target specific survey completed.
SA = Special animal (e.g., state listed and monitor species).
SI = Split territory.
ZA = Zapped animal. Site no longer supports original occurrence.

Accuracy : Mapping accuracy of the site as determined by the individual doing the mapping.
C = Accurate to within 1/4 mile radius and confirmed by a reliable source.
G = Location known only to a general locality.
N = Accurate to within one mile radius.
U = Accurate to within 1/4 mile radius and unconfirmed by a reliable source.

Scientific Name : Scientific name of the species.

State Status : State listing status of species.
SE = State endangered. SC = State candidate.
ST = State threatened. SM = State monitor.
SS = State sensitive.

Federal Status : Federal listing status of species.
FE = Federal endangered. FC = Federal candidate.
FT = Federal threatened. FCo = Federal concern.

Priority : Species and habitats that are considered to be priorities for conservation and management by Washington Department of Fish and Wildlife (WDFW). For a copy of the most current Priority Habitats and Species List contact WDFW PHS Section at (360)902-2543, or it is available on our web site at http://www.wdfw.wa.gov/hab/phspage.htm.
YES = Indicates that the species is considered a WDFW priority and is on the Priority Habitat and Species List and/or Species of Concern List.
NO = Indicates that the species is not a WDFW priority.

WDFW Region : This contains the WDFW administrative region number 1 through 6.

Verified : Verification code for an observation.
V = Verified by a reliable source, generally WDFW or other agency biologist.
U = Not verified by a reliable source, or identification of species is uncertain.
1 = Confirmed grizzly bear or wolf observation.
2 = Probable grizzly bear or wolf observation.

Township - Range - Section : The legal description of the species occurrence.

Occurrence# : An accession catalog number that combined with sequence number identifies a unique record within a species.

Sequence# : Occurrences with multiple locations of a species.

General Description : Description of location of a species.

Priority Habitats and Species Polygon Report

Form#: 901486 PHS Code: HIHI Species Use: B Common Name: HARLEQUIN DUCK
Season: S Definition: 4 Accuracy: 1 Scientific Name: HISTRIONICUS HISTRIONICUS
State Status: Federal Status: FCo Priority: YES Site Name: SAUK RIVER HARLEQUIN AREA
General Description: HARLEQUIN BREEDING AREAS.

Source: ABRAMS, T; WDW
Source Date: 041581 Source Code: PROF
Synopsis: 2 PAIRS SEEN 1-3 MILES N OF DARRINGTON

Source: DRIKER, BARRY; WDW
Source Date: 041581 Source Code: PROF
Synopsis: 2 PAIRS SEEN WITHIN 1/2 MILE OF SUMMIT TIMBER CO. MILL AT DARRINGTON

Source: KRAEMER, C.
Source Date: 032881 Source Code: PROF
Synopsis: 2 ADULTS SEEN AT THE MOUTH OF THE SUIATTLE, FLYING UPSTREAM.

Codes Used In Priority Habitat and Species Polygon Report

Form# : Unique number that links the information in the reports to features on the map.

PHS Code : This contains a code that identifies the fish and wildlife species found in the area or the habitat that occurs there. List of codes are available in the documentation.

Species Use : Criteria that identifies how the area is used by the indicated species. List of codes are available in the documentation. This field is not used if a habitat is described.

Common Name : Common name of the species or habitat.

Season : Season of species use. Use is indicated by the presence of a non-blank character in one or more postions or sub-strings of the field position.
Position 1: W = Winter use. Position 2: S = Spring use.
Position 3: U = Summer use. Position 4: F = Fall use.
Position 5: S = Severe winter use.

Definition : Identifies the definitions or criteria used to classify the area as a priority. List of codes are available in the documentation.

Accuracy : Mapping accuracy of the line delineation as determined by the mapper.
1 = Accurate within a 1/4 mile. 3 = Location known to within one mile.
2 = Accurate within a 1/2 mile. 4 = Location known to general locality only.

Scientific Name : Scientific name of the species.

State Status : State listing status of species.
SE = State endangered. SC = State candidate.
ST = State threatened. SM = State monitor.
SS = State sensitive.

Federal Status : Federal listing status of species.
FE = Federal endangered. FC = Federal candidate.
FT = Federal threatened. FCo = Federal concern.

Priority : Species and habitats that are considered to be priorities for conservation and management by Washington Department of Fish and Wildlife (WDFW). For a copy of the most current Priority Habitats and Species List contact WDFW PHS Section at (360)902-2543, or it is available on our web site at http://www.wdfw.wa.gov/hab/phspage.htm.
YES = Indicates that the species is considered a WDFW priority and is on the Priority Habitat and Species List and/or Species of Concern List.
NO = Indicates that the species is not a WDFW priority.

Site Name : Name assigned to the area based generally on a local place name.

General Description : Description about the area, including how it is used and why it is important.

Source : Identifies and describes the source responsible for the information described on the form or drawn on the map. Single or multiple sources may be cited.

Source Date : Date of source of information.

Source Code : Code identifying the source of information.

Synopsis : Brief narrative describing content of source of information.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
PRIORITY FISH REPORT FROM THE WASHINGTON LAKES AND RIVERS INFORMATION SYSTEM (WLRIS) DATABASE
FOR TOWNSHIP T29R11E, SECTION 21
Report Date: May 09, 2005

Information About The Fish Presence Report

The fish information in this report only includes information that Washington Department of Fish and Wildlife (WDFW) maintains in a central computer database. This information only documents the location of important fish resources to the best of our knowledge. It is not a complete inventory of the fish species in the state. Fish are identified as priority by WDFW if they meet one of three criterion as listed in the Priority Habitats and Species List. The list is available by contacting WDFW Priority Habitats and Species section at (360)902-2543, or it is available on our web site at http://www.wdfw.wa.gov/hab/phspage.htm. To insure appropriate use of this information users are encouraged to consult with WDFW biologists.

Streams with presence of priority anadromous and resident fish species from the WLRIS database are highlighted on the accompanying map. Due to the complexity of displaying linear features individual species that utilize each river reach are not distinguishable. If more species specific information is needed, users should request individual species maps, digital data, or contact the WLRIS database manager.

State status information is not available in the WLRIS database for these species. Please see WDFW Species of Concern List for current status. For a copy of this list, contact WDFW Endangered Species Section at (360)902-2515, or it is available on our web site at http://www.wdfw.wa.gov/wlm/diversty/soc/soc.htm.

Priority Anadromous Fish Presence:

Code	Common Name	Stream Name	Stream LLID	Record Date
DBT	Dolly Varden/Bull Trout	Glacier Creek	1213921479875	05-01-10
DBT	Dolly Varden/Bull Trout	Seventysix Gulch	1213921479865	05-01-10
DBT	Dolly Varden/Bull Trout	South Fork Sauk River	1213879480978	05-01-10
STWI	Winter Steelhead	South Fork Sauk River	1213879480978	04-02-09
STWI	Winter Steelhead	South Fork Sauk River	1213879480978	04-06-21

Priority Resident Fish Presence:

Code	Common Name	Stream Name	Stream LLID	Record Date
RBT	Rainbow Trout	Silver Creek	1214351478970	04-12-16

Codes Used In The Fish Presence Report

Code : WDFW alphanumeric code that identifies the fish species.

Common Name : Common name of the fish species.

Stream Name : Stream name based on the US Geological Survey, Geographic Names Information System database.

Stream LLID : Unique stream identifier (ID) generated from the node latitude and longitude located at a stream's mouth. This ID is to be construed only as an ID, and not necessarily as a reference to a stream's location.

Record Date : Date the information was entered into the database.

Appendix E.

Ecological Risk-Based Screening Tables

Appendix E1. Ecological Risk-Based Screening for Surface Soil
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest [1]	Maximum Soil Concentration	Exposure Point Concentration [2]	Half of Maximum Sample Reporting Limit	Risk-Based Screening Value				Risk Ratio for				Potential Bioaccumulator? [4]
				Plants	Invertebrates	Birds	Mammals	Plants (Rij) [3]	Invertebrates (Rij) [3]	Birds (Rij) [3]	Mammals (Rij) [3]	
	mg/kg											
Metals												
Aluminum	2.58E+04	1.05E+04	NA	5.00E+01	6.00E+02	4.50E+02	1.07E+02	**2.09E+02**	**1.7E+01**	**2.3E+01**	**9.8E+01**	No
Antimony	1.07E+04	2.41E+03	4.00E+01	5.00E+00	7.80E+01	No Data	1.50E+01	**4.83E+02**	**3.1E+01**	0E+00	**1.61E+02**	No
Arsenic III	4.37E+02	2.76E+02	NA	1.00E+01	6.00E+01	7.00E+00	7.00E+00	**2.8E+01**	**5E+00**	**3.9E+01**	**3.9E+01**	**Yes**
Arsenic V	8.54E+04	5.04E+04	NA	1.00E+01	6.00E+01	1.32E+02	1.32E+02	**5.042E+03**	**8.40E+02**	**3.82E+02**	**3.82E+02**	**Yes**
Arsenic, Total	9.21E+04	2.35E+04	NA	1.80E+01	6.00E+01	7.00E+00	7.00E+00	**1.306E+03**	**3.92E+02**	**3.358E+03**	**3.358E+03**	**Yes**
Barium	1.17E+03	1.55E+02	NA	5.00E+02	3.30E+02	1.02E+02	1.02E+02	3E-01	5E-01	**2E+00**	**2E+00**	No
Beryllium	2.93E+00	4.36E-01	1.00E+00	1.00E+01	4.00E+01	No Data	8.30E+01	4E-02	1E-02	0E+00	5E-03	No
Cadmium	1.14E+02	1.08E+01	5.00E+00	3.20E+01	1.40E+02	1.40E+01	1.40E+01	3E-01	8E-02	8E-01	8E-01	**Yes**
Chromium, Total	2.17E+02	3.98E+01	2.50E+00	4.20E+01	4.20E+01	6.70E+01	6.70E+01	9E-01	9E-01	6E-01	6E-01	No
Cobalt	2.81E+01	7.03E+00	3.00E+00	1.30E+01	1.00E+03	No Data	1.50E+02	5E-01	7E-03	0E+00	5E-02	No
Copper	4.24E+03	7.14E+02	NA	7.00E+01	8.00E+01	2.17E+02	2.17E+02	**1.0E+01**	**9E+00**	**3E+00**	**3E+00**	No
Iron	2.72E+05	7.81E+04	NA	1.00E+01	2.00E+02	No Data	No Data	**7.810E+03**	**3.90E+02**	0E+00	0E+00	No
Lead	8.92E+04	7.93E+03	NA	1.20E+02	1.70E+03	1.18E+02	1.18E+02	**6.6E+01**	**5E+00**	**6.7E+01**	**6.7E+01**	**Yes**
Manganese	7.21E+03	8.18E+02	NA	2.20E+02	4.50E+02	1.50E+03	1.50E+03	**4E+00**	**2E+00**	5E-01	5E-01	No
Mercury	3.63E+01	3.61E+00	NA	3.00E-01	1.00E-01	5.50E+00	5.50E+00	**1.2E+01**	**3.6E+01**	7E-01	7E-01	**Yes**
Mercury, Methyl	4.00E-02	4.00E-02	NA	2.00E-04	No Data	4.00E-01	4.00E-01	**2.00E+02**	0E+00	1E-01	1E-01	No
Nickel	8.27E+01	2.11E+01	5.00E+01	3.80E+01	2.80E+02	9.80E+02	9.80E+02	6E-01	8E-02	2E-02	2E-02	No
Selenium	1.74E+01	2.23E+00	5.00E+00	5.20E-01	4.10E+00	3.00E-01	3.00E-01	**4E+00**	5E-01	**7E+00**	**7E+00**	**Yes**
Silver	4.15E+02	8.81E+01	1.50E+00	5.60E+02	5.00E+01	No Data	No Data	2E-01	**2E+00**	0E+00	0E+00	No
Thallium	1.58E+01	5.20E+00	5.00E+00	1.00E+00	1.00E+00	No Data	1.00E+00	**5E+00**	**5E+00**	0E+00	**5E+00**	No
Vanadium	1.04E+02	3.52E+01	2.50E+00	2.00E+00	No Data	4.70E+01	2.50E+01	**1.8E+01**	0E+00	7E-01	1E+00	No
Zinc	1.85E+04	1.32E+03	NA	1.60E+02	1.20E+02	3.60E+02	3.60E+02	**8E+00**	**1.1E+01**	4E+00	**4E+00**	No

	1.5208E+04	**1.747E+03**	**3.889E+03**	**4.130E+03**	:Sum of Rij (Rj)
	22	22	22	22	:Number of COIs (Nij)
	5E-02	5E-02	5E-02	5E-02	:1/Nij

NOTES:
Abbreviations: Bold = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower)
3 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
5 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected).
b) The chemical of interest is a bioaccumulator.
c) No SLV or bioaccumulation vaule is available.
d) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

Appendix E1. Ecological Risk-Based Screening for Surface Soil (continued)
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest [1]	Risks Posed to Protected Plants (Rij>1) [5]	Risked Posed to Non-Protected							Risks Posed to Protected				Risks Posed to Non-Protected			
		Plants (Rij>5) [5]	Risks Posed to Protected Invertebrates (Rij>1) [5]	Invertebrates (Rij>5) [5]	Risks Posed to Protected Birds (Rij>1) [5]	Birds (Rij>5) [5]	Risks Posed to Protected Mammals (Rij>1) [5]	Mammals (Rij>5) [5]	Plants	Invertebrates	Birds	Mammals	Plants	Invertebrates	Birds	Mammals
									Due to Elevated Reporting Limit				Due to Elevated Reporting Limit			
Metals																
Aluminum	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Antimony	Yes	Yes	Yes	Yes	NC	NC	Yes	Yes	Yes	No	No	Yes	**Yes**	No	No	**Yes**
Arsenic III	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Arsenic V	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Arsenic, Total	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Barium	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Beryllium	No	No	No	No	NC	NC	No	No	No	No	No	No	No	No	No	No
Cadmium	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Chromium, Total	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Cobalt	No	No	No	No	NC	NC	No	No	No	No	No	No	No	No	No	No
Copper	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Iron	Yes	Yes	Yes	Yes	NC	NC	NC	NC	No	No	No	No	No	No	No	No
Lead	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Manganese	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No
Mercury	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Mercury, Methyl	Yes	Yes	NC	NC	No	No	No	No	No	No	No	No	No	No	No	No
Nickel	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No
Selenium	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	**Yes**	No	**Yes**	**Yes**
Silver	No	No	Yes	Yes	NC	NC	NC	NC	No	No	No	No	No	No	No	No
Thallium	Yes	Yes	Yes	Yes	NC	NC	Yes	Yes	Yes	Yes	No	Yes	**Yes**	**Yes**	No	Yes
Vanadium	Yes	Yes	NC	NC	No	No	No	No	Yes	No	No	No	No	No	No	No
Zinc	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No

NOTES:
Abbreviations: Bold = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower)
3 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
5 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected).
b) The chemical of interest is a bioaccumulator.
c) No SLV or bioaccumulation vaule is available.
d) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

Appendix E1. Ecological Risk-Based Screening for Surface Soil (continued)
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest [1]	Inordinate Contribution to Overall Risk for Protected Species ($R_{ij}/R_j > 1/N_{ij}$)				Inordinate Contribution to Overall Risks ($R_{ij}/R_j > 5/N_{ij}$)				Risks Posed to Protected Species				Risks Posed to Non-Protected Species			
	Plants	Invertebrates	Birds	Mammals	Plants	Invertebrates	Birds	Mammals	Plants	Invertebrates	Birds	Mammals	Plants	Invertebrates	Birds	Mammals
Metals																
Aluminum	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	**Yes**	**Yes**	**Yes**	**Yes**
Antimony	No	No	Unkown	No	No	No	Unkown	No	Yes	Yes	No	Yes	**Yes**	**Yes**	**Unknown**	**Yes**
Arsenic III	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	**Yes**	**Yes**	**Yes**	**Yes**
Arsenic V	Yes	Yes	Yes	Yes	**Yes**	**Yes**	**Yes**	**Yes**	Yes	Yes	Yes	Yes	**Yes**	**Yes**	**Yes**	**Yes**
Arsenic, Total	Yes	Yes	Yes	Yes	**Yes**	**Yes**	**Yes**	**Yes**	Yes	Yes	Yes	Yes	**Yes**	**Yes**	**Yes**	**Yes**
Barium	No	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No	**Yes**	**Yes**
Beryllium	No	No	Unkown	No	No	No	Unkown	No	No	No	No	No	No	No	**Unknown**	No
Cadmium	No	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No	**Yes**	**Yes**
Chromium, Total	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Cobalt	No	No	Unkown	No	No	No	Unkown	No	No	No	No	No	No	No	**Unknown**	No
Copper	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	**Yes**	**Yes**	**Yes**	**Yes**
Iron	Yes	Yes	Unkown	Unkown	**Yes**	**Yes**	Unkown	Unkown	Yes	Yes	No	No	**Yes**	**Yes**	**Unknown**	**Unknown**
Lead	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	**Yes**	**Yes**	**Yes**	**Yes**
Manganese	No	No	No	No	No	No	No	No	Yes	Yes	No	No	**Yes**	**Yes**	No	No
Mercury	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	**Yes**	**Yes**	**Yes**	**Yes**
Mercury, Methyl	No	Unkown	No	No	No	Unkown	No	No	Yes	Unknown	No	No	**Yes**	**Unknown**	No	No
Nickel	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No
Selenium	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	**Yes**	No	**Yes**	**Yes**
Silver	No	No	Unkown	Unkown	No	No	Unkown	Unkown	No	Yes	No	No	No	**Yes**	**Unknown**	**Unknown**
Thallium	No	No	Unkown	No	No	No	Unkown	No	Yes	Yes	No	Yes	**Yes**	**Yes**	**Unknown**	**Yes**
Vanadium	No	Unkown	No	No	No	Unkown	No	No	Yes	Unknown	No	No	**Yes**	**Unknown**	No	No
Zinc	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	**Yes**	**Yes**	**Yes**	**Yes**

NOTES:
Abbreviations: Bold = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower)
3 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
5 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected).
b) The chemical of interest is a bioaccumulator.
c) No SLV or bioaccumulation vaule is available.
d) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

Appendix E2. Ecological Risk-Based Screening for Surface Water
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest (COI) [1]	Exposure Point Concentration [2]	Half of Maximum Sample Reporting Limit	Freshwater Risk-Based Screening Value			Risk Ratio			Bioaccumulator? [3]	Risks Posed				
			Aquatic Life	Birds	Mammals	Aquatic Life (Rij) [2]	Birds (Rij) [2]	Mammals (Rij) [2]		Aquatic Life (Rij>1) [4]	Protected Birds (Rij>1) [4]	Non-Protected Birds (Rij>5) [4]	Protected Mammals (Rij>1) [4]	Non-Protected Mammals (Rij>5) [4]
	mg/L													
Metals														
Aluminum	4.87E-01	1.50E-02	8.70E-02	7.97E+02	8.00E+00	**6E+00**	6E-04	6E-02	No	**Yes**	No	No	No	No
Antimony	8.58E-03	1.00E-02	1.60E+00	No Data	1.00E+00	5E-03	0E+00	9E-03	No	No	NC	NC	No	No
Arsenic III	1.33E-03	NA	1.50E-01	1.80E+01	6.00E+00	9E-03	7E-05	2E-04	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Arsenic V	1.36E+00	NA	1.50E-01	1.80E+01	6.00E+00	**9E+00**	8E-02	2E-01	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Arsenic, Total	6.83E-01	1.85E-04	1.90E-01	1.80E+01	6.00E+00	**4E+00**	4E-02	1E-01	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Barium	6.06E-03	1.00E-03	4.00E-03	1.50E+02	3.90E+01	**2E+00**	4E-05	2E-04	No	**Yes**	No	No	No	No
Cadmium	4.95E-03	2.50E-03	1.62E-04	1.00E+01	8.00E+00	**3.1E+01**	5E-04	6E-04	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Cobalt	7.91E-03	3.00E-03	2.30E-02	No Data	9.00E+00	3E-01	0E+00	9E-04	No	No	NC	NC	No	No
Copper	2.46E-01	5.00E-02	1.34E-03	3.41E+02	5.30E+01	**1.83E+02**	7E-04	5E-03	No	**Yes**	No	No	No	No
Iron	1.02E+01	5.00E-01	1.00E+00	No Data	No Data	**1.0E+01**	0E+00	0E+00	No	**Yes**	NC	NC	NC	NC
Lead	4.70E-02	5.00E-02	1.53E-04	2.80E+01	3.23E+02	**3.07E+02**	2E-03	1E-04	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Manganese	9.73E-01	2.50E-03	1.20E-01	7.24E+03	6.76E+02	**8E+00**	1E-04	1E-03	No	**Yes**	No	No	No	No
Mercury	8.37E-05	1.00E-04	1.20E-05	3.30E+00	1.00E+01	**7E+00**	3E-05	8E-06	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Selenium	3.00E-04	1.50E-03	5.00E-03	3.60E+00	1.50E+00	6E-02	8E-05	2E-04	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Silver	8.65E-04	2.50E-03	1.20E-04	No Data	No Data	**7E+00**	0E+00	0E+00	No	**Yes**	NC	NC	NC	NC
Thallium	3.60E-04	1.00E-03	4.00E-02	No Data	6.00E-02	9E-03	0E+00	6E-03	No	No	NC	NC	No	No
Zinc	1.05E+00	5.00E-02	1.26E-02	1.05E+02	1.23E+03	**8.3E+01**	1E-02	9E-04	No	**Yes**	No	No	No	No

NOTES:
Abbreviations: Bold = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available,
mg/L = milligrams per liter, NA = not applicable, Unknown = Chemical was detected but no screening criteria are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower).
2 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
4 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life.
b) The risk ratio (Rij) is greater than 5 for other species.
c) The chemical of interest is a bioaccumulator.
d) The chemical of interest has an elevated detection limit.
e) No risk-based screening or bioaccumulation vaule is available.
f) Inordinate contribution to overall risk (Rj).

	6.56E+02	1E-01	4E-01	:Sum of Rij (Rj)
	18	18	18	:Number of COIs (Nij)
	6E-02	6E-02	6E-02	:1/Nij

Appendix E2. Ecological Risk-Based Screening for Surface Water (continued)
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest (COI) [1]	Risks Posed to					Inordinate Contribution to Overall Risk for Protected Species ($R_{ij}/R_j > 1/N_{ij}$)			Inordinate Contribution to Overall Risks for Non-Protected Species ($R_{ij}/R_j > 5/N_{ij}$)			Risks Posed to Protected Species			Risks Posed to Non-Protected Species		
	Aquatic Life	Protected Birds	Non-Protected Birds	Protected Mammals	Non-Protected Mammals												
	Due to Elevated Reporting Limit					Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals
Metals																	
Aluminum	No	No	No	No	No	No	No	No	No	No	No	**Yes**	No	No	**Yes**	No	No
Antimony	No	No	No	No	No	No	No	No	No	No	No	No	**Unknown**	No	No	**Unknown**	No
Arsenic III	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Arsenic V	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Arsenic, Total	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Barium	No	No	No	No	No	No	No	No	No	No	No	**Yes**	No	No	**Yes**	No	No
Cadmium	**Yes**	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	Yes	**Yes**	**Yes**
Cobalt	No	No	No	No	No	No	No	No	No	No	No	No	**Unknown**	No	No	**Unknown**	No
Copper	**Yes**	No	No	No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	No	No
Iron	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Unknown**	**Unknown**	**Yes**	**Unknown**	**Unknown**
Lead	**Yes**	No	No	No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Manganese	No	No	No	No	No	No	No	No	No	No	No	**Yes**	No	No	**Yes**	No	No
Mercury	**Yes**	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Selenium	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Silver	**Yes**	No	No	No	No	No	No	No	No	No	No	**Yes**	**Unknown**	**Unknown**	**Yes**	**Unknown**	**Unknown**
Thallium	No	No	No	No	No	No	No	No	No	No	No	No	**Unknown**	No	No	**Unknown**	No
Zinc	Yes	No	No	No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	No	No

NOTES:
Abbreviations: Bold = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available,
mg/L = milligrams per liter, NA = not applicable, Unknown = Chemical was detected but no screening criteria are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower).
2 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
4 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life.
b) The risk ratio (Rij) is greater than 5 for other species.
c) The chemical of interest is a bioaccumulator.
d) The chemical of interest has an elevated detection limit.
e) No risk-based screening or bioaccumulation vaule is available.
f) Inordinate contribution to overall risk (Rj).

Appendix E3. Ecological Risk-Based Screening for Pore Water
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest (COI) [1]	Exposure Point Concentration [2]	Half of Maximum Sample Reporting Limit	Freshwater Risk-Based Screening Value			Risk Ratio			Bioaccumulator? [3]	Risks Posed				
			Aquatic Life	Birds	Mammals	Aquatic Life (Rij) [2]	Birds (Rij) [2]	Mammals (Rij) [2]		Aquatic Life (Rij>1) [4]	Protected Birds (Rij>1) [4]	Non-Protected Birds (Rij>5) [4]	Protected Mammals (Rij>1) [4]	Non-Protected Mammals (Rij>5) [4]
	mg/L													
Metals														
Aluminum	3.01E-02	1.50E-02	8.70E-02	7.97E+02	8.00E+00	3E-01	4E-05	4E-03	No	No	No	No	No	No
Antimony	5.91E-03	1.00E-02	1.60E+00	No Data	1.00E+00	4E-03	0E+00	6E-03	No	No	No	NC	NC	No
Arsenic III	1.38E-04	4.00E-06	1.50E-01	1.80E+01	6.00E+00	9E-04	8E-06	2E-05	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Arsenic V	9.33E-03	7.90E-03	1.50E-01	1.80E+01	6.00E+00	6E-02	5E-04	2E-03	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Arsenic, Total	8.13E-01	NA	1.90E-01	1.80E+01	6.00E+00	**4E+00**	5E-02	1E-01	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Cadmium	0.00E+00	1.00E-03	1.62E-04	1.00E+01	8.00E+00	0E+00	0E+00	0E+00	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Chromium VI	2.00E-02	NA	1.00E-02	7.20E+00	2.50E+01	**2E+00**	3E-03	8E-04	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Copper	0.00E+00	5.00E-03	1.34E-03	3.41E+02	5.30E+01	0E+00	0E+00	0E+00	No	No	No	No	No	No
Lead	2.00E-04	1.50E-03	1.53E-04	2.80E+01	3.23E+02	1E+00	7E-06	6E-07	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Mercury	1.02E-06	NA	1.20E-05	3.30E+00	1.00E+01	8E-02	3E-07	1E-07	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Silver	0.00E+00	2.50E-03	1.20E-04	No Data	No Data	0E+00	0E+00	0E+00	No	No	No	NC	NC	NC
Zinc	6.07E-03	5.00E-03	1.26E-02	1.05E+02	1.23E+03	5E-01	6E-05	5E-06	No	No	No	No	No	No

NOTES:
Abbreviations: Bold = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available,
mg/L = milligrams per liter, NA = not applicable, NC = not calculated, Unknown = Chemical was detected but no screening criteria are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower).
2 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
4 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life.
b) The risk ratio (Rij) is greater than 5 for other species.
c) The chemical of interest is a bioaccumulator.
d) The chemical of interest has an elevated detection limit.
e) No risk-based screening or bioaccumulation vaule is available.
f) Inordinate contribution to overall risk (Rj).

9E+00	5E-02	1E-01	:Sum of Rij (Rj)
1.2.E+01	1.2.E+01	1.2.E+01	:Number of COIs (Nij)
8.3.E-02	8.3.E-02	8.3.E-02	:1/Nij

Appendix E3. Ecological Risk-Based Screening for Pore Water (continued)
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest (COI) [1]	Risks Posed to					Inordinate Contribution to Overall Risk for Protected Species ($R_{ij}/R_j > 1/N_{ij}$)			Inordinate Contribution to Overall Risks for Non-Protected Species ($R_{ij}/R_j > 5/N_{ij}$)			Risks Posed to Protected Species			Risks Posed to Non-Protected Species		
	Aquatic Life	Protected Birds	Non-Protected Birds	Protected Mammals	Non-Protected Mammals												
	Due to Elevated Reporting Limit					Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals
Metals																	
Aluminum	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Antimony	No	No	No	No	No	No	No	No	No	No	No	No	No	Unknown	No	**Unknown**	No
Arsenic III	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Arsenic V	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Arsenic, Total	No	No	No	No	No	**Yes**	No	No	**Yes**	No	No	Yes	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Cadmium	**Yes**	No	No	No	No	**Unkown**	No	No	**Unkown**	No	No	Yes	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Chromium VI	No	No	No	No	No	**Yes**	No	No	**Yes**	No	No	Yes	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Copper	**Yes**	No	No	No	No	**Unkown**	No	No	**Unkown**	No	No	**Yes**	**No**	**No**	**Yes**	No	No
Lead	**Yes**	No	No	No	No	**Yes**	No	No	**Yes**	No	No	Yes	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Mercury	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Silver	**Yes**	No	No	No	No	**Unkown**	No	No	**Unkown**	No	No	**Yes**	No	**Unknown**	**Yes**	**Unknown**	**Unknown**
Zinc	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

NOTES:
Abbreviations: Bold = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available,
mg/L = milligrams per liter, NA = not applicable, NC = not calculated, Unknown = Chemical was detected but no screening criteria are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower).
2 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
4 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life.
b) The risk ratio (Rij) is greater than 5 for other species.
c) The chemical of interest is a bioaccumulator.
d) The chemical of interest has an elevated detection limit.
e) No risk-based screening or bioaccumulation vaule is available.
f) Inordinate contribution to overall risk (Rj).

Appendix E4. Ecological Risk-Based Screening for Sediment
Monte Cristo Mining Area, Mt. Baker-Snoqualmie National Forest

Chemical of Interest (COI) [1]	Sediment Maximum Concentration	Sediment Exposure Point Concentration [2]	Half of Maximum Sample Reporting Limit	Freshwater Sediment Risk-Based Screening Value		Risk Ratio		Bioaccumulator? [4]	Risks Posed to			Risks Posed			Inordinate Contribution to Overall Risks ($R_{ij}/R_j > 5/N_{ij}$)			Risks Posed to Protected Species	Risks Posed? [5]	
				Benthic Invertebrates	Bioaccumulation	Benthic Invertebrates (Rij) [3]	Birds and Mammals (Rij) [3]		Invertebrates (Rij>1) [5]	Protected Fish, Birds, and Mammals (Rij>1) [5]	Non-Protected Birds and Mammals (Rij>5) [5]	Invertebrates	Protected Birds and Mammals	Non-Protected Birds and Mammals						
	mg/kg											Due to Elevated Reporting Limit			Fish, Birds, and Mammals	Benthic Invertebrates	Birds, and Mammals	Fish, Birds and Mammals	Benthic Invertebrates	Birds and Mammals
Metals																				
Aluminum	1.71E+04	1.59E+04	NA	No Data	No Data	0.E+00	0.E+00	No	NC	No	No	No	No	No	Unknown	Unknown	Unknown	No	**Unknown**	No
Antimony	5.10E+01	1.83E+01	NA	3.00E+00	1.00E+01	**6E+00**	**2E+00**	Not Required	**Yes**	**Yes**	**Yes**	No	No	No	Yes	No	**Yes**	**Yes**	**Yes**	**Yes**
Arsenic III	4.27E-03	3.19E-03	NA	6.00E+00	4.00E+00	5E-04	8E-04	Not Required	No	No	No	No	No	No	No	No	No	No	No	No
Arsenic V	5.44E+02	4.39E+02	NA	6.00E+00	4.00E+00	**7.3E+01**	**1.10E+02**	Not Required	**Yes**	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Arsenic, Total	1.09E+03	3.93E+02	NA	6.00E+00	4.00E+00	**6.6E+01**	**9.8E+01**	Not Required	**Yes**	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Barium	1.06E+02	8.96E+01	NA	No Data	No Data	0E+00	0E+00	No	NC	No	No	No	No	No	No	Unknown	Unknown	No	**Unknown**	No
Beryllium	2.30E-01	2.07E-01	1.00E-01	No Data	1.22E+02	0E+00	2E-03	Not Required	NC	No	No	No	No	No	No	Unknown	No	No	**Unknown**	No
Cadmium	3.90E+00	1.49E+00	NA	6.00E-01	3.00E-03	**2E+00**	**4.95E+02**	Not Required	**Yes**	Yes	Yes	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**
Chromium, Total	6.50E+01	4.53E+01	NA	3.70E+01	4.20E+03	1E+00	1E-02	Not Required	No	No	No	No	No	No	No	No	No	No	No	No
Cobalt	1.25E+01	1.15E+01	NA	No Data	No Data	0E+00	0E+00	No	NC	No	No	No	No	No	No	Unknown	Unknown	No	**Unknown**	No
Copper	2.07E+02	9.11E+01	NA	3.60E+01	1.00E+01	**3E+00**	**9E+00**	Not Required	**Yes**	**Yes**	**Yes**	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**
Iron	3.14E+04	2.97E+04	NA	4.00E+04	No Data	7E-01	0E+00	No	No	No	No	No	No	No	No	No	Unknown	No	No	No
Lead	2.78E+02	1.09E+02	NA	3.50E+01	1.28E+02	**3E+00**	8E-01	Not Required	**Yes**	No	No	No	No	No	No	No	**Yes**	No	**Yes**	**Yes**
Manganese	1.51E+03	9.92E+02	NA	1.10E+03	No Data	9E-01	0E+00	No	No	No	No	No	No	No	No	No	Unknown	No	No	No
Mercury	4.60E+00	9.40E-01	2.50E-02	2.00E-01	No Data	**5E+00**	0E+00	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No	Unknown	**Yes**	**Yes**	**Yes**
Mercury, Methyl	1.70E-05	1.70E-05	6.00E-06	No Data	No Data	0E+00	0E+00	No	NC	No	No	No	No	No	No	Unknown	Unknown	No	**Unknown**	No
Nickel	9.65E+01	5.23E+01	NA	1.80E+01	3.16E+02	**3E+00**	2E-01	Not Required	**Yes**	No	No	No	No	No	No	No	No	No	**Yes**	No
Silver	6.94E+00	1.72E+00	2.50E-01	4.50E+00	No Data	4E-01	0E+00	No	No	No	No	No	No	No	No	No	Unknown	No	No	No
Thallium	2.80E-01	2.00E-01	1.00E-01	No Data	7.00E-01	0E+00	3E-01	Not Required	NC	No	No	No	No	No	No	Unknown	No	No	**Unknown**	No
Vanadium	6.62E+01	6.09E+01	NA	No Data	No Data	0E+00	0E+00	No	NC	No	No	No	No	No	No	Unknown	Unknown	No	**Unknown**	No
Zinc	8.06E+02	2.22E+02	NA	1.23E+02	3.00E+00	**2E+00**	**7.4E+01**	Not Required	Yes	**Yes**	**Yes**	No	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**

NOTES:
Abbreviations: Bold = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower)
3 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
Bioaccumulation screening not required when a bioaccumulation screening value is available.
5 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 1 for protected species and benthic invertebrates.
b) The risk ratio (Rij) is greater than 5 for other species.
c) The chemical of interest is a bioaccumulator.
d) The chemical of interest has an elevated detection limit.
e) No risk-based screening or bioaccumulation vaule is available.
f) Inordinate contribution to overall risk (Rj).

1.66E+02	**2.1E+01**	:Sum of Rij (Rj)
21	46	:Number of COIs (Nij)
0.05	0.02	:1/Nij