Record of Decision
Holden Mine Site
Chelan County, Washington

Prepared by
USDA Forest Service

In Cooperation with
US Environmental Protection Agency and
Washington State Department of Ecology

January, 2012
4769-16

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON STATE DEPARTMENT OF ECOLOGY

RECORD OF DECISION

PARTS 1 & 2

THE HOLDEN MINE SITE
CHELAN COUNTY, WASHINGTON

JANUARY 2012

PREPARED BY
USDA FOREST SERVICE
WENATCHEE, WASHINGTON

IN COOPERATION WITH
US ENVIRONMENTAL PROTECTION AGENCY AND
THE WASHINGTON STATE DEPARTMENT OF ECOLOGY

PART 1 – DECLARATION OF THE RECORD OF DECISION

SITE NAME AND LOCATION

Holden Mine is an inactive underground copper mine located in the Railroad Creek valley in Chelan County on the eastern slopes of the Cascade Mountains in Washington State. The mine is located approximately 9 miles west of Lake Chelan and lies within the Okanogan-Wenatchee National Forest except for about 235 acres of patented mining claims owned by Holden Village (see Figure D-1 following this Declaration; tables and additional figures are presented following the main text).

The Holden Mine Site (Site) includes the entire area impacted by releases of hazardous substances from the mine. The mine was formerly operated by the Howe Sound Company.

The former miners' town, Holden Village, is located on National Forest System lands adjacent to the mine and is now occupied by Holden Village, a non-profit Lutheran ministry and community. Holden Village operates under a Special Use Permit with the Forest Service. Holden Village is home to about 60 year-round residents and hosts approximately 5,000 visitors per year.

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) selects the remedy for cleanup of the Holden Mine Site. The United States Department of Agriculture Forest Service (Forest Service) and the United States Environmental Protection Agency (EPA) are issuing this ROD under the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 117(b), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. § 300.430(f)(4). The State of Washington concurs with the Selected Remedy as it satisfies the Washington State Department of Ecology's (Ecology) criteria for selecting a cleanup action under the Model Toxics Control Act (MTCA), Chapter 70.105D RCW and Chapter 173-340 WAC. This decision is based on the Administrative Record for the Site, which is summarized within this ROD.

The Forest Service serves as the lead agency, in cooperation with the EPA and Ecology, for the management of site activities and preparation of this ROD. The Forest Service, Ecology, and EPA (jointly referred to as the Agencies) selected a remedy for the Site after reviewing and considering the information submitted during the public comment period. The Agencies coordinated with the Confederated Tribes and Bands of the Yakama Nation on remedy selection.

ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare, or the environment, from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF SELECTED REMEDY

Overall Cleanup Strategy

This ROD selects a final remedy for the Site. The selected remedy will address the ongoing release of significant contamination from past mining activities including acid mine drainage and releases from tailings and waste rock piles. Hazardous substances from these sources have impacted aquatic life in Railroad Creek, and present unacceptable risks to human health and the environment.

Acid mine drainage (AMD), runoff from the tailings and waste rock piles, and groundwater impacted by leaching from the tailings and waste rock piles (acid rock drainage [ARD]) continue to release hazardous substances that result in substantial adverse effects on groundwater and surface water quality. Surface water in Railroad Creek has concentrations of hazardous substances above aquatic life protection criteria over a distance of 10 miles downstream of the mine. Vegetation is visibly distressed in the wetlands east of Tailings Pile 3, in the area impacted by runoff and shallow groundwater seepage from the tailings pile. Concentrations of contaminants in seeps flowing into the creek are up to several orders of magnitude above cleanup levels.

The overall cleanup strategy is to prevent releases of hazardous substances to surface water by containment, collection, and treatment of impacted groundwater, as well as by preventing the future release of tailings into the creek. Drainage from the mine will be collected and treated to remove hazardous substances, then discharged into Railroad Creek. A fully penetrating barrier wall will be constructed around the tailings piles to contain and collect contaminated groundwater, which will be conveyed to a treatment facility.

Humans and terrestrial ecological receptors will be protected by consolidating and capping the tailings and soil impacted by the tailings, as well as most of the waste rock. Some areas of impacted soil and waste rock located on steep slopes and in areas that have significant habitat value, but which cannot be consolidated or capped without severe adverse effects on this habitat, will be remediated by *in situ* treatment to reduce the mobility and bioavailability of the hazardous substances. Uncontaminated surface water run-on will be diverted around the waste rock and tailings piles to reduce the need for water treatment. Ongoing groundwater, surface water, and biota monitoring will measure the success of different remedial components. The Site's remote location affects the feasibility of the alternatives considered.

Containment is a viable remedy for this Site, since no Principal Threat Wastes (i.e., those sources of materials that are considered to be highly toxic or highly mobile that generally cannot be reliably contained, or that present a significant risk to health or the environment should exposure occur) are present at the Site.

Major Components of the Selected Remedy

The major components of the Selected Remedy for the Site are more fully described below. Refer to Figure D-1 for locations of site features.

Groundwater Containment, Collection, and Treatment

Groundwater that drains from the mine, AMD, will be contained by three hydraulic barriers (bulkheads) in the 1500 Level Main Portal, the 1500 Level Ventilator Portal, and the 1100 Level adit. The 1500 Level bulkheads will release groundwater from the mine in a controlled manner so that it can be conveyed by pipeline to a groundwater treatment facility (treatment facility).

A below-grade groundwater barrier wall will be constructed on the downgradient side of Tailings Pile 1 and the adjoining Lower West Area to contain and collect impacted groundwater. A second groundwater barrier wall and collection system will be located downgradient of Tailings Piles 2 and 3. Construction of groundwater containment around the tailings piles is necessary to prevent further migration of contaminants in groundwater and to protect downgradient surface water. Because of this containment, the areas within the barrier wall are designated as Waste Management Areas (WMAs).

Containment and treatment of groundwater from the WMAs will address the effects of ARD at and beyond the WMA boundaries and enable restoration of groundwater quality outside the WMAs. The selected remedy establishes two WMAs, with the Lower West Area (including Tailings Pile 1 and the main waste rock piles) as one WMA, and Tailings Piles 2 and 3 as a second WMA, with a groundwater point of compliance (POC) associated with each. Groundwater will comply with drinking water standards (MCLs) at and beyond the edge of the WMAs in accordance with the NCP preamble language which sets forth "EPA's policy that for groundwater, "remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area when waste is left in place" (55 Fed. Reg. 8713). Groundwater flow from seeps downgradient of the Honeymoon Heights Waste Rock Piles that exceeds water quality criteria will also be collected and conveyed by pipe to the treatment facility.

Groundwater discharging to surface water must also meet surface water cleanup standards at a POC before the groundwater-surface water interface[1]. Groundwater cleanup levels protective of surface water must be achieved before the portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates to be protective of aquatic life, and not simply in the surface water column after dilution has occurred.

The collected groundwater will be treated by pH adjustment and oxidation to convert dissolved metals into metal hydroxides that will precipitate in the treatment facility ponds and will later be disposed of in an on-site landfill.

Consolidation and Capping of Tailings, Waste Rock, and Impacted Soil

The tailings piles and the main waste rock piles will be regraded to improve slope stability, to improve precipitation runoff, and to reduce infiltration. Impacted soil will be removed from several areas of the Site and consolidated into the tailings piles. Stormwater diversion swales will be constructed upgradient of the tailings piles and the main waste rock piles to reduce surface water run-on and infiltration. The tailings and main waste rock piles will be capped with soil and/or other materials designed to contain the tailings and waste rock, reduce exposure to the environment, and eliminate unacceptable

---

[1] For Ecology's purposes on behalf of the State of Washington, this point is also a conditional POC under MTCA, WAC 173-340-720(8)(c).

risk to terrestrial plants and animals. Native vegetation will be established on the caps to provide long-term erosion resistance and terrestrial habitat.

In situ Remediation

Soil will be treated by *in situ* application of agricultural lime in areas of the Site where soil excavation or capping is not feasible (such as steep slope areas) or where excavation or capping will cause more severe adverse impacts than the existing hazardous substances (e.g., in the Honeymoon Heights waste rock piles and the area downslope of these piles). This *in situ* treatment will adjust pH and thereby reduce bioavailability and mobility of hazardous substances in areas where critical and sensitive habitat limit or preclude more intrusive actions. This includes the areas downslope of Honeymoon Heights (DSHH) waste rock piles, and areas of late succession riparian habitat (primarily in the Lower West Area). In Holden Village, *in situ* treatment is an alternative remediation measure that would avoid disrupting existing structures and utilities.

Surface Water

In addition to the measures described above that will prevent the release of hazardous substances into surface water, the Selected Remedy includes relocation of a portion of Railroad Creek to eliminate the effects of ferricrete (formed from hazardous substances entering the creek) on aquatic receptors, and to prevent instability of the tailings pile slopes from erosion and scour. The extent of creek relocation will be determined during remedial design, since it affects the extent of tailings regrading that will be required to assure stability of the tailings pile slopes, and to enable construction of the groundwater barrier walls and collection system. The new channel will have an impervious lining where needed to prevent infiltration of clean water into contaminated groundwater that will be collected adjacent to the tailings piles.

Institutional Controls

The Selected Remedy also includes institutional controls that will:

- Notify the public of contaminated areas that will be left on the Site, and prevent humans from direct contact with hazardous substances by warning of the risk;

- Protect the integrity of the remedy by preventing changes in Site use that would reduce effectiveness of the remedy;

- Include a requirement for consultation with the Agencies prior to changes in land use to ensure that the remedy remains protective;
- Require a soil management plan to address handling of soil with visible tailings that may be excavated in the future;
- Prevent the potential future use of groundwater that exceeds human health risk-based criteria as a drinking water source, i.e., within WMAs;
- Provide for permanent access to privately owned land to monitor and maintain the remedy; and
- Implement possible administrative access restrictions to some portions of the Site.

The Forest Service will implement institutional controls on National Forest System land through the notation of restrictions in the Forest Service Land Status Records for the Okanogan-Wenatchee National Forest. Institutional controls will be implemented on private property owned by Holden Village through a restrictive covenant.

Sediment

The Selected Remedy includes relocation of a portion of Railroad Creek, which will eliminate the adverse effects of ferricrete on the aquatic habitat. Also the wetland east of Tailings Pile 3 will be remediated or replaced depending on whether the groundwater treatment system is located there.[2] This wetland has been adversely impacted by runoff and sedimentation (as well as shallow groundwater impacted by leaching of the tailings) from the adjacent tailings pile. The Agencies have determined that other active measures to clean up sediment are not warranted at this time as discussed in the final Feasibility Study (see Section 4.1.1.3.4 of the SFS). Rather, the remedy will include source controls and relocation of a portion of Railroad Creek to prevent ongoing release of hazardous substances into Railroad Creek. Long-term monitoring will determine if the remedy is protective of sediment quality.

---

[2] In addition, mitigation will also be required in accordance with Section 404 of the Clean Water Act.

Phased Approach to Remedy Implementation

The Selected Remedy will require several years of construction to implement. The potentially responsible party, Intalco Aluminum Corporation, has proposed and is implementing some early actions to prepare for the larger scale cleanup efforts. These early actions may include remedial design, baseline monitoring, and some construction work such as dock and road improvements; development of quarry, borrow, and staging areas; and construction of hydraulic bulkheads in the mine. The scope, schedule, and details of these early actions are subject to oversight by the Agencies under 2010 and 2011 amendments to an Administrative Order on Consent (AOC).

The Agencies have determined it is beneficial to construct the remedy in two phases, solely to reduce the adverse effects of construction on Holden Village.

- The first phase of the remedy will include relocation of Railroad Creek, construction of the treatment facility, regrading and capping the tailings piles and the main waste rock piles, beginning the *in situ* soil treatment, and construction of the groundwater barrier and collection system downgradient of Tailings Pile 1 and the Lower West Area.

- The second and final phase of the remedy will include construction of the groundwater barrier and collection system downgradient of Tailings Piles 2 and 3. The second phase of construction will begin 5 years after completion of the first phase.

Intalco proposes to monitor the effects of the first phase of the remedy to determine whether results of the first phase support modifying the second phase. Intalco has stated, but has not demonstrated, that construction of the second groundwater barrier wall and collection system will be unnecessary once the first phase of the remedy is completed. Currently there is no evidence that without the additional barrier wall, cleanup levels based on protection of surface water (i.e., the aquatic life criteria, because they are lower than the drinking water criteria) will be met in groundwater before the groundwater discharges into surface water downstream of Tailings Piles 2 and 3. Moreover, without containment, there would not be a WMA and MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3, or there would need to be an applicable or relevant and appropriate requirement (ARAR) waiver for MCLs based on technical impracticability from an engineering perspective, which, if justified, would require a ROD Amendment. Such an ARAR waiver would not be approved unless the remedy was shown to be protective, including the protection of aquatic life where groundwater discharges to surface water, and the establishment of institutional controls to prevent use of groundwater for drinking water below the tailings piles.

The period between the first and second phase presents an opportunity for Intalco to collect data in an effort to support a proposal to modify the second phase. The ROD allows for the collection of additional data following implementation of the first phase cleanup components and includes the provision that the barrier wall design could be modified or would not need to be installed, if demonstrated to satisfy ARARs and be protective within a timeframe comparable to the Selected Remedy. The second phase of the remedy would not need to be installed only if it can be demonstrated to the Agencies' satisfaction that:

1. Groundwater concentrations are reduced to achieve surface water cleanup levels before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates; and

2. One of the following: a) groundwater meets MCLs below Tailings Piles 2 and 3, as well as throughout the plume; or b) groundwater that exceeds drinking water standards will be contained within a WMA; or c) an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective is justified.

Such a change would require a ROD Amendment. The basis for the change must be demonstrated within three years of substantial completion of the first phase of remedial construction, so that a decision can be made in the fourth year. Unless the second phase groundwater barrier and collection system is eliminated, the second phase of remedial action is expected to be designed in the fifth year and constructed immediately thereafter.

STATUTORY DETERMINATIONS

The Selected Remedy attains the mandates of Section 121 of CERCLA, 42 U.S.C. § 9621 and, to the extent practicable, the NCP, 40 C.F.R. Part 300. The Selected Remedy will:

- Be protective of human health and the environment;
- Comply with applicable or relevant and appropriate requirements (ARARs), unless a waiver is justified;
- Be cost-effective;

- Use permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable; and
- Satisfy the statutory preference for treatment as a principal element of the remedy (i.e., which permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances as a principal element through treatment).

After the Selected Remedy is implemented, hazardous substances that exceed levels that allow unlimited use and unrestricted exposure will remain on the Site. Statutory reviews will be conducted at least every 5 years after the remedial action begins to ensure that the Selected Remedy is, or will be, protective of human health and the environment.

DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary (Part 2) of this ROD. More information is available in the Administrative Record for the Site.

- Contaminants of concern (COCs) and their respective concentrations. (See Section 5.3.1)
- Baseline risk represented by the COCs. (See Sections 7.1 and 7.2)
- Cleanup levels established for the COCs and the basis for the levels. (See Section 7)
- Whether source materials constituting Principal Threat Wastes are present at the Site. (See Section 11)
- Current and reasonably anticipated future land uses and current and potential future groundwater use assumptions used in the baseline risk assessment and ROD. (See Section 6)
- Potential land and groundwater use that will be available at the Site as a result of the Selected Remedy. (See Section 12.3)
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs of the remedy, including the discount rate used and the number of years over which the remedy cost estimate is projected. (See Section 12.1)
- Key factors that led to selecting the remedy. (See Section 10)

AUTHORIZING SIGNATURES FOR THE RECORD OF DECISION FOR THE HOLDEN MINE SITE (Sheet 1 of 3)

United States Department of Agriculture
Forest Service Region 6
By: ______________________ 1/26/12
for Kent P. Connaughton Date
Regional Forester

AUTHORIZING SIGNATURES FOR THE RECORD OF DECISION FOR THE HOLDEN MINE SITE (Sheet 2 of 3)

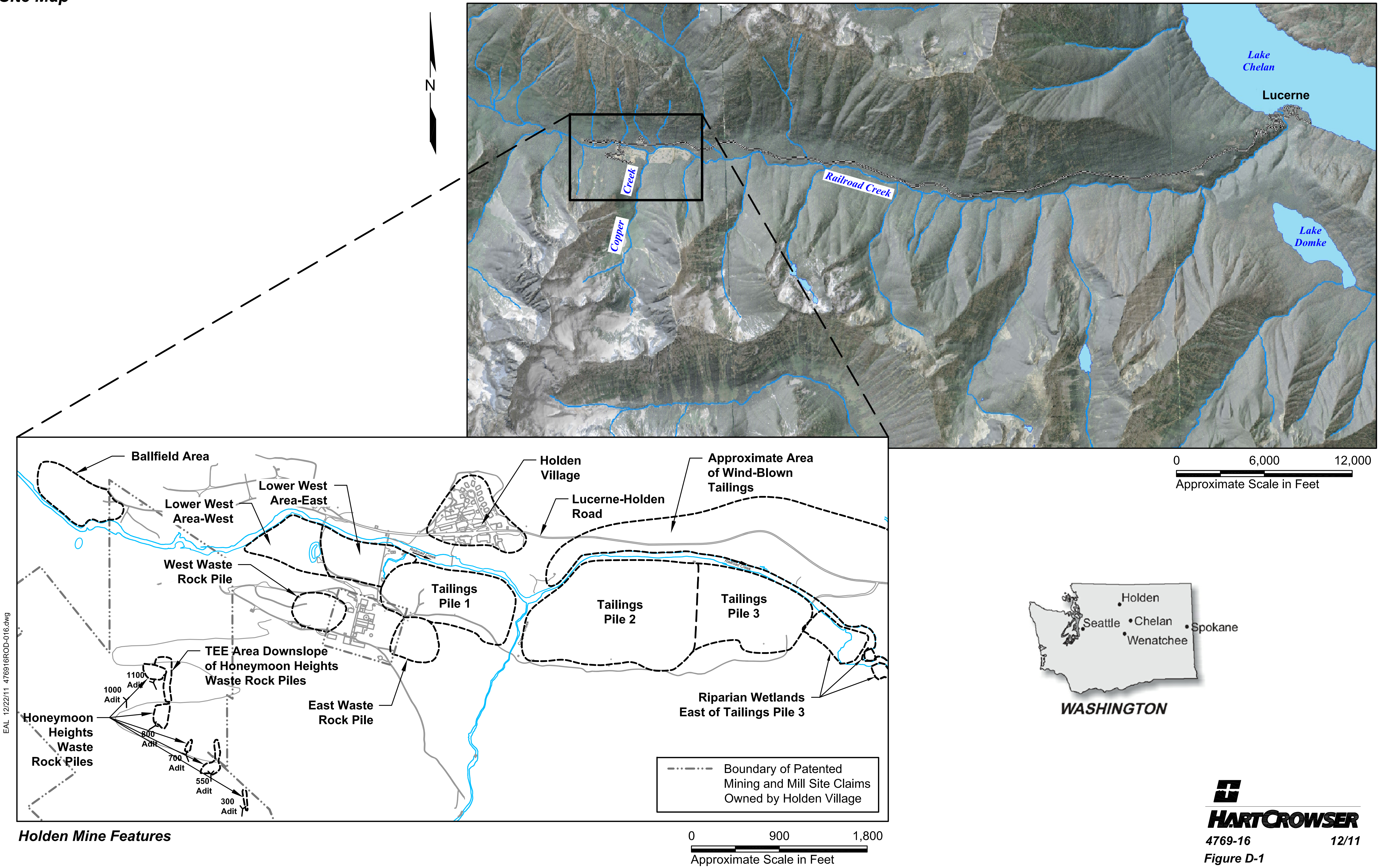
U.S. Environmental Protection Agency
By: ______________________ 1/27/2012
Daniel D. Opalski Date
Director, Office of Environmental Cleanup, Region 10

AUTHORIZING SIGNATURE FOR ADOPTION OF THE RECORD OF DECISION FOR THE HOLDEN MINE SITE AS A CLEANUP ACTION PLAN UNDER WAC 173-340-380(4) (Sheet 3 of 3)

Washington State Department of Ecology
By: ______________________
James J. Pendowski
Program Manager, Toxics Cleanup Program

1/26/12
Date

Site Map



Holden Mine Features

HARTCROWSER

4769-16 12/11

Figure D-1

ROD

CONTENTS Page

PART 1 – DECLARATION OF THE RECORD OF DECISION

SITE NAME AND LOCATION 1-1

STATEMENT OF BASIS AND PURPOSE 1-1

ASSESSMENT OF THE SITE 1-2

DESCRIPTION OF SELECTED REMEDY 1-2

Overall Cleanup Strategy 1-2
Major Components of the Selected Remedy 1-3

STATUTORY DETERMINATIONS 1-8

DATA CERTIFICATION CHECKLIST 1-9

SIGNATURE PAGES

FIGURES

D-1 Site Map (following Declaration)

LIST OF ACRONYMS AND ABBREVIATIONS VI

PART 2 – DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION 2-1

1.1 Agency Authorities and Roles 2-2

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES 2-3

2.1 Mining History 2-3
2.2 Enforcement History 2-4
2.3 Past Site Response Actions 2-5
2.4 Site Investigation Activities 2-6

3.0 COMMUNITY PARTICIPATION 2-12

CONTENTS (Continued) Page

4.0 SCOPE AND ROLE OF THE RESPONSE ACTION 2-13

4.1 Early Works 2-14
4.2 Phase I 2-14
4.3 Phase 2 2-15

5.0 SITE CHARACTERISTICS 2-16

5.1 Conceptual Site Model 2-17
5.2 Physical Characteristics of the Site 2-17
5.3 Summary of the Nature and Extent of Contamination 2-24

6.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES 2-28

6.1 Current Land Use 2-28
6.2 Anticipated Future Land Use 2-30
6.3 Surface Water and Groundwater Uses 2-30

7.0 SUMMARY OF RISKS 2-31

7.1 Overview of Risk Assessment and Cleanup Level Process 2-31
7.2 Human Health Risk 2-39
7.3 Ecological Risks 2-40
7.4 Basis for Action 2-45

8.0 REMEDIAL ACTION OBJECTIVES 2-46

8.1 Remedial Action Objectives 2-46
8.2 Basis for RAO Selection 2-47

9.0 DESCRIPTIONS OF ALTERNATIVES 2-50

9.1 Description of Alternatives 11M, 12, 13M, and 14 2-52

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES 2-68

10.1 Evaluation of Alternatives under CERCLA 2-68
10.2 Evaluation of Alternatives under MTCA 2-88

11.0 PRINCIPAL THREAT WASTE 2-97

CONTENTS (Continued)

Page

12.0 THE SELECTED REMEDY 2-97

12.1 Summary of the Rationale for the Selected Remedy 2-97
12.2 Description of the Selected Remedy 2-98
12.3 Summary of Estimated Remedy Costs 2-111
12.4 Expected Outcome of the Selected Remedy 2-111
12.5 National Historic Preservation Act 2-113

13.0 STATUTORY DETERMINATIONS 2-115

13.1 Protection of Human Health and the Environment 2-115
13.2 Compliance with Applicable or Relevant and Appropriate Requirements 2-116
13.3 Cost-Effectiveness 2-116
13.4 Use of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable 2-118
13.5 Preference for Treatment as a Principal Element 2-119
13.6 Five-Year Review Requirements 2-119

14.0 DOCUMENTATION OF SIGNIFICANT CHANGES FROM THE PREFERRED ALTERNATIVE IN THE PROPOSED PLAN 2-120

15.0 REFERENCES 2-122

TABLES

Tables are located following the main text (except where noted).

1 Summary Statistics for Groundwater, Surface Water, and Soil
2 Chemical-Specific ARARs for Drinking Water
3 Chemical-Specific ARARs and Background Concentrations for Surface Water
4 Areas of the Site with Groundwater Concentrations That Exceed Drinking Water Criteria
5 Concentrations of Contaminants of Concern in Surface Water
6 Concentrations of Contaminants of Concern in Sediment
7 Bioassay Requirements
8 Concentrations of Contaminants of Concern in Soil
9 Human Health-Based Chemical-Specific ARARs and Background Concentrations for Soil
10 Areas of the Site with Soil Concentrations That Exceed Human Health Criteria
11 Summary of Contaminants of Concern and Cleanup Levels
12 Terrestrial Ecological Hazard Quotients for Soil

CONTENTS (Continued) Page

TABLES (Continued)

13	Ecological Exposure Pathways of Concern	
14	Description of Alternatives and Sub-Alternatives 1 through 10	
15	Summary Comparison of Alternatives 11M, 13M, and 14	
16	Chemical-Specific ARARs for Selected Remedy	
17	Action-Specific ARARs for Selected Remedy	
18	Location-Specific ARARs for Selected Remedy	
19	TBC Criteria for the Selected Remedy	
20	Points of Compliance	
21	Net Present Value of Alternatives (In Text)	2-84
22	Estimated Costs for the Selected Remedy (In Text)	2-98
23	Cost Breakdown for the Selected Remedy	

FIGURES

Figures are located following Tables after the main text.

1	Site Location and Project Vicinity Map
2	Land Use Map
3	Site Map
4	Principal Site Features Map
5	Summary Conceptual Site Model
6	Groundwater Elevations and Generalized Flow Map—July 2008 (Sheet 1 of 2)
	Groundwater Elevations and Generalized Flow Map—October 2008 (Sheet 2 of 2)
7	Seeps and Flow Tubes That Discharge into Railroad Creek for Spring Conditions
8	Seeps and Flow Tubes That Discharge into Railroad Creek for Fall Conditions
9	Ratio of Groundwater (Including Seep) Concentrations to Cleanup Levels for Major Source Areas
10	Ratio of Groundwater (Including Seep) Concentrations to Cleanup Levels for Spring Conditions
11	Ratio of Groundwater (Including Seep) Concentrations to Cleanup Levels for Fall Conditions
12	Groundwater Concentrations and Railroad Creek Stream Conditions East of Tailings Pile 3
13	Ratio of Surface Water Concentrations to Cleanup Levels
14	Waste Management Areas
15	Principal Components of Alternative 11M
16	Principal Components of Alternative 13M
17	Principal Components of Alternative 14
18	Principal Components of Selected Remedy

CONTENTS (Continued) Page

APPENDIX A
SUBSTANTIVE NATIONAL HISTORIC PRESERVATION ACT (NHPA) MEASURES A-1

PART 3 - RESPONSIVENESS SUMMARY

(Provided as a separate volume)

LIST OF ACRONYMS AND ABBREVIATIONS

AHPA	Archaeological and Historic Preservation Act
AKART	all known, available, and reasonable methods of treatment
asl	above sea level (referring to elevation)
AMD	acid mine drainage
AOC	Administrative Order on Consent
AOI	area of interest
APR	Agencies Proposed Remedy
ARARs	applicable or relevant and appropriate requirements
ARD	acid rock drainage
ASFS	Addendum to the Supplemental Feasibility Study
BO	Biological Opinion
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	Code of Federal Regulations
COC	contaminant of concern
COPC	contaminant of potential concern
CRP	community relations plan
CWA	Clean Water Act
CUL	cleanup level
DFRI	Draft Final Remedial Investigation
DFS	Draft Feasibility Study
DFFS	Draft Final Feasibility Study
DRI	Draft Remedial Investigation
DSHH	areas downslope from Honeymoon Heights Waste Rock Piles
DOS	Dam Safety Officer
EC	environmental checklist (i.e., the SEPA checklist that was issued with the Proposed Plan)
Ecology	Washington State Department of Ecology
Eco-SSL	Ecological Soil Screening Level
EIS	Environmental Impact Statement
EISC	Environmental Indicator Soil Concentrations
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
ESD	Explanation of Significant Differences
Forest Service	United States Department of Agriculture, Forest Service
FS	Feasibility Study
gpm	gallons per minute
FSQV	freshwater sediment quality value
HHRA	human health risk assessment
HQ	hazard quotient

LBI	Lutheran Bible Institute
L&I	Labor and Industries (Washington Department of)
LOAEL	lowest observed adverse effects level
LRMP	Land and Resource Management Plan
LWA	Lower West Area
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
mg/kg	milligrams per kilogram
MSHA	Mine Safety and Health Administration
MTCA	Model Toxics Control Act
MWFP	Pacific Northwest Forest Plan
NCP	National Oil and Hazardous Substances Contingency Plan
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act
NOAEL	no observed adverse effects level
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NRRB	National Remedy Review Board
NTR	National Toxics Rule
NWQC or NRWQC	National Recommended Water Quality Criteria
O&M	operation and maintenance
OMM	operations, maintenance, and monitoring (costs)
OSHA	Occupational Safety and Health Administration
POC	point of compliance
PRPs	potentially responsible party
RAO	remedial action objective
RBCs	risk-based concentrations
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remediation Project Manager
SEPA	State Environmental Policy Act
SFS	Supplemental Feasibility Study
SRA	surface water retention area
TBC	to be considered (criteria)
TEE	Terrestrial Ecological Evaluation
TRVs	Toxicity Reference Values
UAO	Unilateral Administrative Order
UCL	upper confidence limit
ug/L	micrograms per liter

U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAC	Washington Administrative Code
WER	Water Effects Ratio
WMA	Waste Management Area
WSDFW	Washington State Department of Fish & Wildlife

PART 2 – DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION

Holden Mine is an inactive underground copper mine located in the Railroad Creek valley on the eastern slopes of the Cascade Mountains in Chelan County, Washington State. The mine, formerly operated by the Howe Sound Company, is located approximately 9 miles west of Lake Chelan and lies mostly within the Okanogan-Wenatchee National Forest. The mine is located in the Railroad Creek Watershed that drains to Lake Chelan (Figures 1 and 2).

The mine is very remote. It is only accessible by passenger ferryboat service, commercial barge service, private boat, and/or floatplane from Chelan, Washington, up Lake Chelan to Lucerne. At Lucerne, at the mouth of Railroad Creek, a climbing, winding gravel road is the only route for vehicles to access the mine. The Glacier Peak Wilderness Area abuts the mine on three sides. The former miners' town, Holden Village, is located on National Forest System lands adjacent to the mine and is now occupied by a non-profit Lutheran ministry and community. Holden Village operates under a Special Use Permit with the Forest Service. Holden Village is home to about 60 year-round residents and hosts approximately 5,000 visitors per year.

The Site, shown on Figure 3, includes the entire area impacted by releases of hazardous substances from past mining activities that cause acidic drainage from the mine (AMD) and the waste rock and tailings piles (ARD). The Site also includes about 10 miles of the Railroad Creek drainage extending downstream from the mine to Lake Chelan, Holden Village, and outlying areas such as Honeymoon Heights (described in more detail in Section 5.2).[3]

The Site is one of the larger cleanup sites in the State of Washington, extending from the former mine operations along an approximately 10-mile reach of the Railroad Creek Watershed to Lake Chelan. Contamination from the mining operation results primarily from metals and depressed pH and, to a lesser extent, petroleum hydrocarbons.

---

[3] Although the mine is a bit less than 9 miles from Lake Chelan, the total length of the watershed impacted by releases from the mine is about 10 miles based on meanders in Railroad Creek.

Major features of the mine area cover about 125 acres and include a former Mill Building, approximately 8.5 million tons of tailings piles, and about 250,000 tons of waste rock piles. The 1500 Level Portal (Main Portal) of the mine and the former Mill Building are located on the south side of the valley, near the base of a relatively steep valley slope. The waste rock piles and tailings piles are located south of and adjacent to Railroad Creek.

AMD from the mine and ARD from the waste rock and tailings piles continue to release substantial quantities of metals from the waste rock and tailings piles into surface water and groundwater at the Site. The Main Portal discharges highly contaminated water at flow rates between 90 gallons per minute (gpm) in the fall and around 1,200 gpm in the spring. These and other sources on the Site contain concentrations of hazardous substances exceeding levels that are protective of human health and the environment. Groundwater discharges into surface water with concentrations of hazardous substances exceeding levels protective of aquatic receptors. Surface water and sediment contain hazardous substances above levels protective of aquatic life.

1.1 Agency Authorities and Roles

The United States Department of Agriculture, Forest Service (Forest Service) is the lead agency for CERCLA site activities. The Forest Service is acting in cooperation with the Washington State Department of Ecology (Ecology) and the United States Environmental Protection Agency (EPA). The Forest Service, Ecology and EPA are collectively referred to as the Agencies.

The Forest Service and EPA are issuing this ROD under the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Section 117(b), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. § 300.430(f)(4).

In addition, independent of the federal application of CERCLA, the State of Washington is concurrently asserting jurisdiction over the Site cleanup. The State of Washington's cleanup authority for this Site is MTCA, which is applicable to the Site under state law [RCW 70.105D]. Ecology is concurrently adopting this ROD as a cleanup action plan under MTCA [see WAC 173-340-380(4)]. While many provisions of MTCA are applicable or relevant and appropriate requirements (ARARs) under CERCLA and are thus germane to the CERCLA decision-making process, this ROD also includes discussion of MTCA provisions to serve Ecology's purposes in making a cleanup action decision under MTCA. Where such discussion occurs, it is generally identified as "for Ecology's purposes" and is not part of the CERCLA decision-making process.

The majority of the land at the Site is within the Okanogan-Wenatchee National Forest. However, the Mill Building, a portion of the main East and West Waste Rock Piles, and Honeymoon Heights are located on private land owned by Holden Village.

The Agencies anticipate that the cleanup will be funded by the potentially responsible party (PRP), Intalco Aluminum Corporation, in accordance with a Consent Decree to be negotiated with the Agencies, or a Unilateral Administrative Order (UAO).

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 Mining History

Mining first started in the late 1800s and early 1900s along Railroad Creek. The underground mine and facilities that later became known as the Holden Mine were initially developed in the area known as Honeymoon Heights (Figure 3). The Honeymoon Heights area consists of six mine adits (mine entrances) and associated piles of waste rock from underground tunnels developed during early mining operations at the Site.

Howe Sound Company took over mining operations in 1938. The mining company acquired permits from the Forest Service and other relevant agencies to further develop the mine and construct the mill and related facilities as well as a mine town site, Holden Village. Mine development included an ore haul-out tunnel (the Main Portal) and a mine ventilation tunnel constructed near the level of the mill facility, noted on mine maps as the 1500 Level. Ore milling began in 1938 and continued until 1957.

In 1960, Howe Sound transferred its patented land and unpatented mining claims and other assets to the Lutheran Bible Institute (LBI). In 1961, LBI transferred the property to Holden Village, a non-profit corporation, to operate a Lutheran ministry and community in the former miners' town site (see Figure 4).

Ore removal resulted in the reported development of about 56 miles of underground mine workings. Old mine maps show that the mine workings included 14 primary mine levels and approximately the same number of secondary mine levels. Horizontal levels were developed for ore removal every

50 to 100 feet from the top to bottom extent of the mine workings. The different levels of the mine were connected by a series of inclines, two shafts, and air passageways. The mine extended to a depth of approximately 800 feet below Railroad Creek.

Economic minerals—primarily copper, zinc, silver, and gold—were removed from the ore by crushing and processing in the mill. The resulting ore concentrate was then transported off site for smelting. On-site ore processing generated approximately 10 million tons of tailings, which are a mixture of silt and fine sand resulting from ore crushing. Approximately 1.5 million tons of tailings were used to backfill part of the mine during operations to increase the stability of the underground openings below the 1500 Level.

The remainder of the tailings were hydraulically placed in three piles covering approximately 75 acres north and east of the Mill Building (Figure 4). The piles range from about 40 to 120 feet high and contain an estimated 8.5 million tons of tailings. Construction of the tailings piles required relocating Railroad Creek north of the existing stream channel; therefore, portions of the tailings piles are over the now-abandoned channel.

Two large waste rock piles were placed on the west and east sides of the Mill Building (Figure 4). The waste rock piles consist of an estimated 250,000 tons of rock removed from the underground mine that did not contain sufficient concentrations of economic minerals to warrant processing in the mill.

After mining operations ceased in 1957, the mine partially filled with groundwater and water began to drain out of the 1500 Level Main Portal. Drainage from the Main Portal varies annually from about 90 gpm in the fall to around 1,200 gpm (and occasionally higher) in the spring, and discharges overland into Railroad Creek. An underground collapse in 1970 temporarily blocked water discharge from the Main Portal until the water pressure was sufficient to breach the collapsed rock and soil overburden. The surge of released water eroded a portion of the West Waste Rock Pile and turbid water entered Railroad Creek. The force of the released water eroded a cut approximately 10 feet deep where it crossed the road by Holden Village's garage (Forest Service 1970).

2.2 Enforcement History

In 1993, the Agencies identified Alumet Corporation (a successor in interest to Howe Sound) as a potentially responsible party (PRP) for the Holden Mine cleanup action. On April 11, 1998, Alumet and the Agencies entered into an Administrative Order on Consent/Agreed Order (AOC) to conduct a Remedial Investigation/Feasibility Study (RI/FS) for cleanup of the Site. Alumet Corporation subsequently merged into Intalco Aluminum Corporation and is hereafter referred to as Intalco. Intalco and the United States also entered into a Consent Decree on April 5, 2000, for reimbursement of past response costs and other Consent Decree requirements.

2.3 Past Site Response Actions

Between 1989 and 1991, the Forest Service performed the following site response actions:

- Regraded the tailings pile surfaces to increase surface water runoff;
- Constructed diversion ditches to reduce surface water run-on to the tailings piles;
- Constructed channels within the Copper Creek drainage to direct flow between Tailings Piles 1 and 2 through two culverts located at the southern edge of the piles;
- Reduced erosion of the tailings piles along Railroad Creek by placing riprap on the stream banks; and
- Placed about 6 inches of gravel over the surface of the tailings piles to reduce wind-borne transport of tailings.

The Forest Service, with help from Holden Village, revegetated portions of the tailings piles and conducted limited revegetation studies in several test plots on the piles in the 1990s. Reports from the Forest Service indicate that some of these efforts have been relatively successful, especially when biosolids were added as a soil amendment (presentation by George Scherer, Forest Service, at Holden Mine Acid Mine Drainage Workshop, October 1999).

Active treatment of the acid mine drainage (AMD) was not included in the Forest Service actions. However, to add alkalinity and increase the precipitation of metals from the portal drainage before it reaches Railroad Creek, limestone rock fragments were placed on the drainage substrate as a form of passive treatment. This method was not successful, because the limestone surfaces were quickly coated (or blinded) with metal precipitates.

In 2000, Intalco secured the mine entries and fenced off the abandoned Mill Building to prevent trespass. Subsequently in 2003, 2004, and 2006, Intalco completed the following additional time-critical stabilization measures to control erosion and repair flood damage to the tailings piles:

- In October 2003, flooding caused damage at the Site that warranted immediate action to avoid further damage to the environment. Of particular concern was the damage to riprap protection along the toe of the tailings piles, as well as a gully that formed across Tailings Pile 1. The Forest Service approved an Action Memorandum on November 12, 2003, for a time-critical removal action to be conducted under the existing CERCLA AOC between Intalco and the Agencies. The time-critical removal action began on November 14, 2003, and was successfully completed before November 25, 2003.

- In 2004, additional stream bank protection and stabilization of the Railroad Creek channel at and upstream of the vehicle bridge was required to prevent further erosion of stream bank sediment that could potentially release contaminants to the environment. It was important to complete this work without delay because of the potential for high water during winter storms and spring 2005 snowmelt to erode the channel upstream of the bridge. The Forest Service approved an Action Memorandum on August 23, 2004, for a time-critical removal action under the AOC. This time-critical removal action began on October 4, 2004, and was successfully completed before October 25, 2004.

- During the spring of 2006, high water in Railroad Creek and Copper Creek resulting from rapid snowmelt caused additional erosion of Tailings Piles 1 and 2, requiring more repairs. The Forest Service approved an Action Memorandum on August 28, 2006, for a time-critical removal action under the existing AOC. This time-critical removal action began on September 27, 2006, and was successfully completed by October 1, 2006.

2.4 Site Investigation Activities

The 1998 AOC documents an agreement the Agencies reached with Intalco directing Intalco to perform a detailed cleanup study of the Site. The study information, data, and regulatory and technical analyses used for Site characterization, alternatives analysis, and selection of a final remedy are presented in a series of documents and reports in the Administrative Record. The cleanup study documented findings in a Remedial Investigation (RI) that characterized the conditions, nature and extent of contamination, and site risks. A Feasibility Study (FS) evaluated remediation options. This section summarizes the activities conducted as part of the overall cleanup study of the Site.

2.4.1 Remedial Investigation

Intalco conducted the RI between 1997 and 1999. The RI included the sampling and analysis of soil, surface water, groundwater, and sediment; and documented other site information. Limited ecological and human health risk assessments were conducted as part of the RI. The Draft Final Remedial Investigation (DFRI) was submitted on July 28, 1999.

On February 8, 2002, the DFRI (Dames and Moore 1999) was accepted as final by the Agencies (Forest Service 2002). Acceptance was based on the expectation that the subsequent Feasibility Study would provide additional information missing from the RI to resolve a number of Agency comments on the DFRI report.

Additional site investigations completed before and after submittal of the DFRI report are also relevant to the development and analysis of candidate remedial alternatives. The following transmittals summarize the results of additional site investigations:

- Holden Mine Fall 2000 and Spring 2001 Underground Investigation Data Transmittals (URS 2001a; URS 2001b). These documents present the findings of three investigations into the 300, 1100, and 1500 levels of the underground mine in November 2000, April 2001, and May 2001.

- Fall 2001 and Spring/Summer/Fall 2002 Hydrogeologic Investigation Data Transmittals (URS 2002a; URS 2002e; URS 2002f; URS 2003b). These documents present the results of the installation and sampling of five new downgradient groundwater monitoring wells from November 2001 through October 2002.

- Fall 2001 Geotechnical/Geochemical Investigation Data Transmittal (URS 2002c). This document presents the results of geotechnical and geochemical sampling and analysis of tailings performed in conjunction with the fall 2001 hydrogeologic investigation noted above.

- Fall 2001 and Fall 2002 Additional Lake Chelan Sediment Sampling Data Transmittals (URS 2002d; URS 2003c). These documents present sediment chemistry, grain size analyses, and toxicity testing data associated with sediment sampling performed at Lucerne bar and Stehekin (the reference site) in Lake Chelan. Sampling was conducted in November 2001 and October 2002.

- Final Monitoring Report – Bat Monitoring and Winter Survey of Underground Mine Workings at the Holden Mine Site (URS 2003a). This document presents the results of site surveys and remote monitoring conducted in 2001 and 2002 within the underground workings of the Holden Mine to establish the presence or absence of bats.

- Spring 2003 Surface Water Monitoring Data Transmittal (URS 2003d). This document presents the results of Railroad Creek and portal drainage water quality sampling conducted from May 20 through May 21, 2003.

- Results of Humidity Cell Testing on Tailings (SRK 2003). This document presents the results of humidity cell testing conducted in 2002 and 2003 on three tailings samples collected from the Holden Mine Site during the fall 2001 geochemical investigation.

2.4.2 Natural Resources Damages Assessment

In addition, as agreed upon in the AOC, a Draft Injury Determination Memo, dated February 15, 2002, was prepared to summarize potential injuries to natural resources at the Site to evaluate the potential for coordinated remedial and natural resource restoration activities.

2.4.3 Feasibility Study

Initial phases of the FS began in 1999. The Draft Feasibility Study (DFS) was delivered to the Agencies for review on June 12, 2002. There were eight alternatives with eight sub-alternatives analyzed in the DFS as well as a “no action” alternative. The Draft Final Feasibility Study (DFFS) was delivered to the Agencies and Trustees for review on February 19, 2004 (URS 2004). Sixteen alternatives and sub-alternatives were analyzed in the DFFS along with the no action alternative.

During the spring and summer of 2005, following Intalco’s submittal of the DFFS, the Agencies concluded that none of the 16 alternatives and sub-alternatives presented within Alternatives 1 through 8 would meet the threshold CERCLA remedial action selection criteria, based on information provided by

Intalco. The threshold requirements under CERCLA are protection of human health and the environment, and compliance with applicable or relevant and appropriate requirements (ARARs).[4]

---

[4] Applicable requirements are defined in the NCP(40 C.F.R. § 300.5) as: "Applicable requirements means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable."

Relevant and Appropriate requirements are defined in the NCP (40 C.F.R. § 300.5) as: "Relevant and appropriate requirements means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate."

ARARs fall into three broad categories, based on the manner in which they are applied: chemical-, action-, and location-specific.

Chemical-specific ARARs include requirements that regulate the release to, or presence in, the environment of materials with certain chemical or physical characteristics, or containing specified chemical compounds. The requirements are usually either health- or risk-based numerical values or methodologies that establish the acceptable amount or concentration of a chemical that may remain in or be discharged to the environment.

Action-specific ARARs set performance, design, or similar controls or restrictions on particular kinds of activities related to the management of hazardous substances, pollutants, or contaminants. The need to follow these ARARs depends on the particular remedial action selected for implementation. Action-specific ARARs indicate how, or to what level, the alternative must achieve the requirements. For example, the National Pollutant Discharge Elimination System (NPDES) discharge requirements are an action-specific ARAR when the remedy includes a groundwater treatment facility that

MTCA has similar threshold requirements. A detailed discussion of the threshold requirements is presented in Section 4.1.1.2 of the Supplemental Feasibility Study (SFS) prepared by the Agencies (Forest Service 2007b). The DFFS alternatives that failed to satisfy the threshold requirements under CERCLA and MTCA cannot be considered as a final cleanup action for the Site. Based on this determination, the Agencies proposed consideration of new alternatives.

The Agencies proposed an alternative referred to as the Agencies Proposed Remedy (APR). The APR combined elements of some of the alternatives described in the DFFS and included a partially penetrating barrier to contain groundwater for collection and treatment. On September 1, 2005, the Agencies transmitted the APR to EPA's National Remedy Review Board (NRRB) for evaluation (Hart Crowser 2005a).

On November 18, 2005, Intalco proposed consideration of a new remedial alternative, identified as Alternative 9 (URS 2005). Alternative 9 consisted of DFFS Alternative 3b, combined with pumping from wells and seeps to clean up

---

discharges treated effluent to surface water. In general, only the substantive requirements of an ARAR need to be implemented at a site.

Location-specific ARARs are restrictions based on the concentration of hazardous substances or the conduct of activities in specific locations. They relate to the geographic or physical position of a site. Remedial actions may be restricted or precluded depending on the location or characteristics of a site and the requirements that apply to it. Location-specific ARARs may apply to actions in natural or manmade features. Examples of natural site features include wetlands and floodplains. An example of a manmade feature is an archaeological site. Also, since the Site is located within the Glacier Peak Wilderness Area Class 1 Airshed, specific air quality ARARS need to be addressed under the Clean Air Act (42 U.S.C. § 7401 et Seq.; 40 C.F.R. Part 50) and related regulations.

"To be considered" materials (TBCs) are non-promulgated criteria, advisories, guidance, and proposed standards issued by federal, state, or tribal governments that, although not legally enforceable, may be helpful in establishing protective cleanup levels and developing, evaluating, or implementing remedy alternatives. TBCs are not ARARs but are meant to complement the use of ARARs. If no ARARs address a particular chemical or situation, or if existing ARARs do not provide adequate information, TBCs may be available for use in developing remedial alternatives.

groundwater from below a limited area of Tailings Pile 1. For consistency in alternative numbering, the APR was established as Alternative 10.

After meeting with the NRRB and reviewing the NRRB's comments, and after meeting with Intalco and Holden Village, the Agencies concluded that Alternatives 1 through 9 would not meet the threshold criteria for selection of a cleanup action [40 C.F.R. § 300.430(f)(1)(i)(A) and WAC 173-340-360(2)], and that available information was not sufficient to demonstrate that Alternative 10 satisfied the threshold requirements. Therefore, none of these potential remedies qualified as a final remedy. Accordingly, the Agencies developed Alternative 11 by combining elements of the earlier alternatives to create a proposed remedy that they believed satisfied the CERCLA and MTCA threshold criteria, and Alternative 12, a true "no-action" alternative as required under CERCLA. Alternatives 9, 10, 11 and 12 were further evaluated in the Supplemental Feasibility Study (SFS, Forest Service 2007b).

On September 13, 2007, the Agencies initially accepted a final Feasibility Study (Forest Service 2007d) consisting of:

- The Draft Final Feasibility Study and Intalco's Alternative 9 Description as modified and supplemented by the Agencies' Comments on the Draft Final Feasibility Study (Forest Service 2007a),

- The Agencies' comments on Intalco's Alternative 9 Description (Forest Service 2007c), and

- The Supplemental Feasibility Study (Forest Service 2007b).

On October 15, 2007, Intalco proposed another new remedial approach that it referred to as Alternative 13 (Intalco 2007). Alternative 13 featured the relocation of Railroad Creek and used the existing creek bed to collect contaminated groundwater from the tailings piles rather than using a barrier wall and collection trench, as proposed in Alternative 11. The Agencies concluded there was not sufficient information in the Administrative Record file at that time to assess whether Alternative 13 would satisfy the CERCLA and MTCA requirements.

In 2008 and 2009, Intalco performed additional field investigations to address data gaps that the Agencies had identified. Based on the initial results of these investigations, Intalco revised Alternative 13, designating the new alternative as Alternative 13M. Intalco presented the results of the additional investigations, including an evaluation of Alternative 13M and Alternative 11, in the Draft Alternative 13M Evaluation Report (ERM and URS 2009).

In June 2010, the Agencies completed the Addendum to the 2007 Supplemental Feasibility Study (ASFS) (Forest Service 2010a) to present relevant information not included in the Draft Alternative 13M Evaluation Report, update the remedial action objectives (RAOs), and to describe and evaluate three remedial alternatives that were developed after the 2007 Supplemental Feasibility Study (Alternatives 11M, 13M, and 14). As part of preparing the ASFS, the Agencies developed a new alternative (Alternative 14) to address certain Alternative 13M deficiencies related to protection of surface water and remediating soil to achieve soil cleanup standards, and also refined Alternative 11 (now referred to as Alternative 11M) to reflect the additional data Intalco collected in 2008 and 2009.

The Agencies did not require Intalco to resubmit the Feasibility Study. Rather, the Agencies accepted a final Feasibility Study (Forest Service, March 30, 2010) that consists of:

- The Draft Final Feasibility Study (URS 2004) and Intalco's Alternative 9 Description (URS 2005), as modified and supplemented by the Agencies' Comments on the Draft Final Feasibility Study (Forest Service 2007a) and the Agencies' comments on Intalco's Alternative 9 Description (Forest Service 2007c);

- The SFS (Forest Service 2007);

- Intalco's Draft Alternative 13M Evaluation Report (August 14, 2009) as modified and supplemented by the Agencies' comments (Forest Service 2010b); and

- The ASFS (Forest Service 2010).

These documents are included in the Administrative Record for the Site.

3.0 COMMUNITY PARTICIPATION

The Agencies developed a community relations plan (CRP) for the Site in April 1998. The CRP was designed to promote public awareness of cleanup activities and investigations, and to promote public involvement in the decision-making process. This section summarizes the community relations activities performed by the Agencies during the remedy selection process.

Interviews were held in 1998 in communities near the Site: Holden Village, Chelan, and Wenatchee. These interviews provided the Agencies with background on local awareness of, and interest in the Site. Holden Village is well known in the area. The CRP summarized the concerns of local citizens, interest groups, industries, and local government representatives. Community participation activities included personal interviews, distribution of fact sheets, newspaper notices, and public notices. During the RI/FS, the Agencies consulted with Holden Village about anticipated future land, groundwater, and surface water uses at the Site.

The April 1998 Community Relations Plan was revised in December 2007 and again in March 2010 to provide a framework for informing the public about the draft Proposed Plan and other site activities. Before release of the Proposed Plan, the Agencies participated in a series of meetings (from the fall of 2007 through early summer 2010) in which remedial alternatives were discussed with Intalco and representatives of Holden Village.

The Proposed Plan was released for public comment on June 23, 2010. The initial 45-day comment period was extended for an additional 45 days at Intalco's request. Public comments were received over a 90-day period, ending September 22, 2010. This included four public meetings that the Agencies arranged in Chelan, Wenatchee, Holden, and Seattle. A court reporter prepared a transcript of oral comments from these meetings. Comments were also received by US Postal Service and e-mail. The Agencies received comments from more than 100 individuals and organizations. These comments are addressed in the Responsiveness Summary, included as Part 3 of this ROD.

Documents considered or relied on in selecting the final remedy, including public comments on the Proposed Plan, are available to the public in the Administrative Record. The Administrative Record is available at the Okanogan-Wenatchee National Forest Headquarters in Wenatchee, at Ecology's Central Regional Office in Yakima, and at EPA's Region 10 office in Seattle.

4.0 SCOPE AND ROLE OF THE RESPONSE ACTION

This ROD presents the final cleanup of impacts from past and ongoing soil, sediment, surface water, and groundwater contamination at the Site. The remedy selected by the Agencies and documented in this ROD includes remedial actions necessary to protect human health and the environment. While contamination will remain at the Site, the Selected Remedy will protect human health and the environment.

The selected remedy will be implemented in phases, including an early works phase (in part, conducted under a Removal Action) to prepare for two phases of major construction. The phases are described in the following sections.

4.1 Early Works

The early works phase consists of Site access improvements that are necessary before major construction starts. The early works include dock and barge unloading facility improvements, and improvements to the Lucerne-Holden Road that will be used for site access. The access road improvements will include widening some areas of the road, construction of turnouts, temporary and permanent bridge improvements, and a new road segment so that construction traffic can bypass Holden Village. Other early works activities include construction staging areas; relocation or protection of Holden Village infrastructure (e.g., water supply and vehicle maintenance facilities); construction of hydraulic bulkheads to contain groundwater in the underground mine; and limited removal or capping of impacted soil in specific areas (e.g., staging areas).

4.2 Phase 1

The first major construction phase of the remedy will include construction of a groundwater treatment facility, construction of a groundwater barrier around Tailings Pile 1 and the Lower West Area, beginning *in situ* soil treatment in some areas of interest (AOIs), and regrading and capping the main waste rock piles and the tailings piles. The cap will be designed to eliminate the risk of dispersion from wind and water erosion, prevent human contact with the wastes, and eliminate unacceptable risk to terrestrial plants and animals. Groundwater from the Lower West Area and Tailings Pile 1 area, seeps, and flow from the mine will be conveyed to the new groundwater treatment facility.[5] *In situ* treatment of

---

[5] At various times, both Intalco and the Agencies have proposed use of one or two facilities for treatment of groundwater, to address differences in water quality and hydraulic gradient in different areas of the Site. For convenience, this ROD refers to a single water treatment facility that will likely be located north of Railroad Creek, but recognizes that final location, number of treatment facilities and treatment technology will be based on design studies and approved by the Agencies. Also, since the Selected

impacted soil that is not amenable to consolidation and capping is anticipated to continue periodically over time, depending on results of treatability studies and monitoring.

4.3 Phase 2

A second phase of major construction will follow completion of the first phase. The Agencies determined it is appropriate to begin the second phase of heavy construction 5 years after completion of the first phase to reduce the adverse effects of construction on the residents of Holden Village. While this approach will extend the period during which groundwater that exceeds cleanup levels is only partially contained and treated, the first phase of remedy construction will prevent risks to human health and most terrestrial receptors, except in the wetland downgradient of Tailings Pile 3. The first phase of heavy construction will also significantly reduce the release of groundwater containing hazardous substances into Railroad Creek. The remaining release of contaminated groundwater, ARD, will be addressed by the second phase of heavy construction.

During the interim between the first and second phases, the groundwater treatment plant will be fully operational and its design and operation can be modified as needed to improve treatment effectiveness. This is an important aspect of the remedy, since completion of the second phase will roughly double the flow of groundwater that must be treated to a total of about 600 million gallons per year.

The second phase of major construction includes installation of a second groundwater barrier and collection system downgradient of Tailings Piles 2 and 3, and possibly expansion of the groundwater treatment facility. This second and final phase is planned to occur 5 years after the first phase of major construction is complete. The delay between phases will allow Holden Village to reestablish operations that will be interrupted during the first phase.

Before completion of the Proposed Plan and during public comments, Holden Village managers and residents expressed concerns that construction will have such a major impact on life in the Village that its continued viability will be at

---

Remedy will be implemented in phases, the timing for expansion of the groundwater treatment facility will be determined during remedial design.

risk. The Agencies will allow a 5-year hiatus between major stages of construction to reduce the effects of construction on Holden Village residents and operations.

Intalco has stated, but has not demonstrated, that construction of the second groundwater barrier wall and collection system will be unnecessary once the first phase of the remedy is completed. Currently, there is no showing that without the second phase of remedy construction, groundwater cleanup levels would be met in groundwater under and downgradient of Tailings Piles 2 and 3.

The period between the first and second phase presents an opportunity for Intalco to collect data in an effort to support a proposal to modify the second phase. The ROD allows for the collection of additional data following implementation of the first phase cleanup components, and includes the provision that the barrier wall design could be modified or would not need to be installed, if demonstrated to satisfy ARARs and be protective within a timeframe comparable to the Selected Remedy. The second phase of the remedy would not need to be installed only if it can be demonstrated to the Agencies' satisfaction that:

1. Groundwater concentrations are reduced to achieve surface water cleanup levels before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates; and

2. One of the following: a) groundwater meets MCLs below Tailings Piles 2 and 3, as well as throughout the plume; or b) groundwater that exceeds drinking water standards will be contained within a WMA; or c) an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective is justified.

Such a change would require a ROD Amendment. The basis for the change must be demonstrated within three years of substantial completion of the first phase of remedial construction, so that a decision can be made in the fourth year. Unless the second phase groundwater barrier and collection system is eliminated, the second phase of remedial action is expected to be designed in the fifth year and constructed immediately thereafter.

5.0 SITE CHARACTERISTICS

This section summarizes information obtained through the RI/FS process. It includes a description of the conceptual site model upon which investigations, the assessment of risks, and response actions are based. The major characteristics of the Site and the nature and extent of contaminant releases are summarized below. More detailed information is contained in the RI/FS and supporting documents, which are included in the Administrative Record.

5.1 Conceptual Site Model

The conceptual site model depicted on Figure 5 shows the relationships between the sources of hazardous substances and exposure pathways for human and ecological receptors at the Site. The primary sources of contamination are the tailings piles, waste rock piles, and drainage from the mine, which all release hazardous substances into the groundwater and surface water. The tailings and waste rock piles are the source of ARD that seeps into the groundwater and later enters Railroad Creek (and in the case of the tailings piles, some seeps directly enter the creek, e.g., SP-2). The mine is a source of AMD that currently flows from the 1500 Level Portal through an open channel to enter Railroad Creek at the sampling point designated P-5. Additional sources of hazardous substances include soil that is impacted by dispersion of the tailings, as well as mine operations such as equipment maintenance. Potential human receptors include Holden Village residents, recreational users of the Site, and workers. Ecological receptors include fish, benthic macroinvertebrates, and other organisms in Railroad Creek, as well as a variety of plants and wildlife.

5.2 Physical Characteristics of the Site

The Site is located in the Railroad Creek Watershed, which is situated approximately two-thirds of the way up the west side of Lake Chelan. The Site is within the Okanogan-Wenatchee National Forest except for some patented mining claims owned by Holden Village (see Figure 4) and some private residences near the mouth of Railroad Creek at Lucerne. The watershed is generally oriented in an east-west direction and is approximately 20 miles long. The Railroad Creek drainage is generally a glacially carved u-shape, with steep side slopes. The portion of the drainage near Lake Chelan slopes gently at the mouth of the creek for approximately one-half mile. It then becomes very steep, with several waterfalls. The drainage then transitions to a more moderate gradient that extends westward past the mine to the western end of the drainage, where the drainage again steepens before reaching its headwaters at Cloudy Pass. Elevations of Railroad Creek range from about 1,100 feet above sea level (asl) at Lucerne, which is located on Lake Chelan, to about 6,500 feet asl at the headwaters in the Glacier Peak Wilderness. The Holden Mine workings are approximately 10 miles up the Railroad Creek drainage from Lake Chelan.

Railroad Creek is the second largest hydrologic source to Lake Chelan and contributes approximately 10 percent of the annual basin input. The area where the mine operated is the largest of only a few floodplain valley reaches in the Railroad Creek drainage and one of the few floodplain valleys in the entire Lake Chelan drainage. Therefore, this floodplain valley is important to the overall ecology of the Lake Chelan Basin. The forest surrounding the Site provides key habitat for riparian-dependent species and important resources for both riparian and upland species.

The Main Portal of the mine and the former Mill Building are located on the south side of the watershed, near the base of the relatively steep valley slope (Figure 4). Most of the abandoned mine facilities and tailings are between 3,200 and 3,450 feet asl; for comparison, the elevation of Railroad Creek is about 3200 feet asl adjacent to Holden Village . The surface expression of the Honeymoon Heights mine workings range in elevation up to approximately 4,600 feet asl.

5.2.1 Surface Features

The Site includes a number of informal AOIs that were defined for the purposes of the terrestrial ecological evaluation (TEE), as well as other site features. These features are shown on Figure 4 and are described in the following subsections.

Tailings Piles 1, 2, and 3

Tailings at the Site occur in three main piles identified as Tailings Piles 1, 2, and 3, located along the south side of Railroad Creek. Tailings are also dispersed in other areas, such as the east portion of the Lower West Area and an extensive area impacted by wind-blown tailings north and east of the main tailings piles, as described below. The three main piles, which range in height up to about 120 feet above Railroad Creek, are estimated to contain approximately 8.5 million tons of tailings covering an area of roughly 75 acres.

East and West Waste Rock Piles

The East and West Waste Rock Piles consist of an estimated 250,000 tons of waste rock that cover about 8 acres, and range in height up to about 165 feet.

Honeymoon Heights Waste Rock Piles

The Honeymoon Heights Waste Rock Piles consist of five discrete waste rock piles associated with the 300, 550, 700, 800, and 1,100 Level mine portals. These waste rock piles are estimated to have a combined volume of about 49,000 cy, covering an area of about 5 acres. The Honeymoon Heights Waste Rock Piles are located between about elevation 3,800 to 4,600 feet across a relatively steep north-facing slope that varies from about 50 percent (2H:1V) to 200 percent (1H:2V).

The Honeymoon Heights Waste Rock Piles are located on private land, except for possibly a small portion that may be located on National Forest System land. The piles are located in an area that is biologically important as functional riparian habitat as described in the Draft Terrestrial Ecological Evaluation (TEE) completed in March 2009 (ERM 2009).

TEE Areas Downslope from the Honeymoon Heights Waste Rock Piles

The TEE described an AOI consisting of about 3 acres of riparian forest habitat directly downslope from the Honeymoon Heights Waste Rock Piles (DSHH) associated with the 300, 550, 700, 800, and 1100 Level portals, as shown on Figure 4. Similar to the Honeymoon Heights Waste Rock Piles, the DSHH areas are located on a relatively steep north-facing slope.

The DSHH areas are on private land in an area that is biologically important as functional riparian habitat.

Ballfield Area

The Ballfield Area covers an area of about 8 acres, including the former miners' village baseball field, a campground, a portion of a hiking trail (formerly the Mary Green Mine haul road), and the adjacent area. The Ballfield Area is primarily on National Forest System land, although a small portion is on patented land owned by Holden Village.

Holden Village

The former miners' town site covers about 11 acres and includes about 25 buildings, as well as roads and landscaped areas. Holden Village continues to occupy the former company town under a Special Use Permit from the Forest Service. The residential buildings in the village are located on National Forest

System land. Approximately 60 adults and children live at Holden Village year-round. In addition, approximately 5,000 to 6,000 people visit the facility each year, with each person generally staying 2 to 7 days. Holden Village uses part of the private property (patented mining claims) it owns for infrastructure support—hydroelectric power generation, recycling, and woodcutting—and vehicle maintenance and parking.

Lower West Area

The Lower West Area covers an area of about 15 acres located south of Railroad Creek and west of Tailings Pile 1. The Lower West Area is roughly bisected by a road running south from the bridge over Railroad Creek to the Holden Village Maintenance Yard. The eastern portion of the Lower West Area is referred to as Lower West Area-East and the western portion is called Lower West Area-West, excluding the Lagoon Area. An ephemeral pond, referred to as the Lagoon, is located along this road and is considered as a separate AOI, as discussed below.

Lagoon Area

The Lagoon Area was reportedly excavated as a surface water management facility during mine operations, and may also have been used for temporary storage of tailings slurry that was pumped to the tailings piles, or perhaps for backfilling portions of the underground mine. The Lagoon Area covers an area of about 1 acre and contains visible tailings accumulations. There are also tailings in the soil within the former Lagoon footprint.

Wind-Blown Tailings Area

The Wind-Blown Tailings Area extends over an area of about 77 acres located north and east of Tailings Pile 2 and Tailings Pile 3. This area is mostly coniferous forest, with a strip of riparian wetland habitat along Railroad Creek. The Wind-Blown Tailings Area has intermittent visible accumulations of tailings. A portion of this area nearest to the creek was clear-cut and became reforested in the early 1960s; other areas were selectively harvested and have residual old growth structure. The remainder has not been logged and has well-established native vegetation.

Maintenance Yard

The Maintenance Yard is an area of about 1 acre where Howe Sound and, subsequently, Holden Village performed equipment maintenance. The surface of the Maintenance Yard is densely compacted gravelly soil with little or no existing vegetation.

Former Mill Building

The former Mill Building is located between the East and West Waste Rock Piles, and extends over an area of about 2 acres. The ground surface is largely covered by concrete slabs and walls, along with debris and remnants of the steel superstructure. The dilapidated condition of the former Mill Building did not allow safe access during the RI to fully characterize potential hazardous substances.

Ventilator Portal Surface Water Retention Area

The Ventilator Portal Surface Water Retention Area is apparently a former water detention pond that is located downslope of the 1500 Level Ventilator Portal. The former pond in the Surface Water Retention Area is an excavation with a perimeter berm covering less than about a half acre. There are tailings in the soil within the former pond footprint.

Lucerne-Holden Road

In September 2009, the Forest Service identified an April 24, 1940, memorandum from the District Ranger, W. O. Shambaugh (Forest Service 1940), indicating that the Howe Sound Company was proceeding with plans to resurface the road between Lucerne and Holden (Figure 3). The memorandum stated that the contractor for the job would install a rock crusher on the “waste dump at the mine” to obtain material for the resurfacing. Subsequent file searches by the Forest Service have not confirmed that this resurfacing plan was actually implemented. Pending further investigation, the Agencies assume that waste rock may have been used for resurfacing the Lucerne-Holden Road and that those portions of the road may be a source of hazardous substances within the Site.

Other Areas of the Site

There are several other areas of the Site where former mine activities are associated with the release of hazardous substances to the environment. These areas include:

Underground Mine Workings. Approximately 10 million tons of ore were excavated from the Holden Mine during its operation. The tunnels excavated to develop the mine reportedly total 56 miles in length. Within these mine workings, dissolved metals and sulfates from the walls of the openings (and from tailings that were backfilled into the mine) add to the contaminant load carried by the portal drainage to Railroad Creek. In addition, air flow through the workings increases oxidation of sulfide minerals which, in turn, increases solubility of metals, further increasing the contaminant load.

Both Intalco and the Agencies assessed the potential for mine subsidence. Intalco reported that the rock spanning the uppermost stopes (large open underground rooms where the ore was excavated) within the mine is "marginally stable." Analysis by the Agencies indicated that there is about a 75 percent probability that these rock spans (referred to as crown pillars) will someday collapse, and that the resulting ground surface subsidence would likely increase air and water movement through the abandoned workings. An increase in air or water flow through the workings could increase the rate of hazardous substances released from the Main Portal drainage.

Railroad Creek. Railroad Creek, from the Surface Water Retention Area downstream to Lake Chelan, is part of the Site, see Figure 4.

Copper Creek. Copper Creek flows into Railroad Creek from the south, passing between Tailings Piles 1 and 2. Copper Creek has actively eroded portions of both Tailings Piles 1 and 2 (in 2003 and 2006) causing a release of tailings into Railroad Creek. South (upslope) of the mine, a portion of Copper Creek is diverted into a penstock that supplies drinking water and hydroelectric power to Holden Village. Discharge from the generator station north (downslope) of the Maintenance Yard flows overland and into Railroad Creek. This overland flow, referred to as the Copper Creek Diversion, has eroded a portion of Tailings Pile 1 into Railroad Creek.

Riparian Wetland East of Tailings Pile 3. Riparian wetlands covering a total area of approximately 5 acres are located immediately east of Tailings Pile 3 along Railroad Creek. These riparian wetlands are adversely impacted by erosional deposition of tailings, runoff, and shallow groundwater contaminated by seepage from Tailings Pile 3, based on field observations of distressed vegetation and soil staining.

Lucerne Bar. The Lucerne Bar is the area where sediment in Railroad Creek is deposited as the creek discharges into Lake Chelan.

5.2.2 Surface Water Hydrology and Groundwater

Surface water and groundwater are primary pathways for the transport and release of contaminants of concern (COCs) at the Site. Surface water and groundwater on the Site are generally controlled by the physical conditions of the watershed, including the natural topography, geology, and climate as well as mine-related alterations to the topography and geology.

Flow in Railroad Creek is generally low from late summer through winter and highest during the months of May and June, coinciding with snowmelt in the basin. Monthly average stream flow at Lucerne varies from a low of about 21,000 gpm to peak flows averaging 280,000 gpm (USGS 2011).

During spring snowmelt (generally April through July), the primary surface water and groundwater discharges to Railroad Creek occur upstream of the Site and originate as glacial water and snowmelt. For the remainder of the year, storage within the weathered bedrock soil and glacial sand and gravel, as well as storm event precipitation, provide the base flow (groundwater discharging to the creek) for Railroad Creek.[6] On the Site, Railroad Creek is the primary receptor of surface water and groundwater discharging to surface water.

Groundwater is present at the Site in a shallow unconfined alluvial aquifer that is hydraulically connected to Railroad Creek. Figure 6 shows generalized groundwater elevation contours and groundwater flow directions. The DRI, as well as recent investigations, (URS 2008 and URS 2009b) have shown that Railroad Creek consists of alternating segments where groundwater flows upward into the creek (gaining reaches) and where water from the creek flows downward into the alluvial aquifer (losing reaches). Conceptual groundwater flow paths under spring and fall conditions are illustrated on Figure 6 and show a relatively complex relationship between the surface water and groundwater, which affects the transport of contaminants.

---

[6] Flow in Railroad Creek is generally low from late summer through winter. As described in the RI/FS, spring conditions generally refer to the 90-day May to July period when snowmelt causes relatively high groundwater levels and relatively high flow conditions in Railroad Creek. In contrast, fall conditions represent the other 275 days per year (August to April) typified by lower groundwater levels and relatively low flows in Railroad Creek.

5.2.3 Geology

Site geology generally consists of stream alluvium and glacial deposits overlying bedrock. Alluvium on the Site ranges from silty, sandy gravel to coarse gravel that is transported and deposited by surface water. Glacial deposits on the Site consist of a combination of glacial drift and basal till. Glacial drift is silt- to boulder-sized material deposited either by retreating glaciers or from rivers draining glaciers. Basal till is silt- to boulder-sized material deposited beneath or ahead of the glacier. In some locations on the Site, glacial drift has been further reworked by subsequent stream action.

Alluvial soils and glacial outwash deposits are the primary media for groundwater flow that transports contaminants at the Site. The alluvium and glacial materials are underlain at variable depths by bedrock that has been carved by the glaciation process, and includes sedimentary, metamorphic and igneous rock types. Dense basal till has been observed to blanket the bedrock in some of the geologic borings completed in the vicinity of Railroad Creek at the Site.

The permeability of the basal till is expected to be low, based on the higher proportion of fines and increased density of the material. The permeability of the bedrock is also anticipated to be relatively low. The potential exists for preferential groundwater pathways along fractures, joints, and faults within the bedrock. However, even within the preferential pathways, the movement of groundwater within bedrock is anticipated to be relatively low based on observations made during the underground mine investigations.

5.3 Summary of the Nature and Extent of Contamination

This section summarizes the nature and extent of contamination at the Site. Table 1 provides summary statistics for groundwater, surface water, and soil. Sections 7.1 through 7.3 provide additional detail about risks to humans, plants, and animals associated with the contamination.

Sections 5.3.1 through 5.3.5 describe the nature and extent of contamination for each media (groundwater, surface water, sediment, soil, and air, respectively). Key findings from the RI and subsequent investigations include:

- Tailings and waste rock (ARD) and the mine (AMD) contribute to low pH and high metals content in groundwater and surface water that causes significant contamination within the Site.

- Concentrations of hazardous substances in groundwater exceed human health criteria for drinking water in some portions of the Site.

- Groundwater containing concentrations of hazardous substances above levels protective of fish and benthic macroinvertebrates discharges into surface water.

- Where groundwater discharges to surface water, concentrations of hazardous substances in seeps and pore water discharging to Railroad Creek are above levels protective of fish and benthic macroinvertebrates in seeps discharging to Railroad Creek and in pore water.

- Concentrations of hazardous substances in surface water (Railroad Creek and the Copper Creek Diversion) are consistently above levels protective of aquatic health for fish and benthic macroinvertebrates.

- High concentrations of hazardous substances present in pore water, surface water, and sediment have reduced the populations of fish and benthic macroinvertebrates in Railroad Creek adjacent to and downstream of the mine, and have also impacted sediments at the Lucerne Bar.

- Concentrations of hazardous substances in mine tailings, waste rock, and soil at the Site exceed criteria for protection of human health, including direct contact and ingestion, and criteria for protection of the environment.

- Tailings pile slope instability from an earthquake or erosion presents a risk of additional hazardous substance releases into Railroad and Copper Creeks.

5.3.1 Groundwater

Groundwater exceeds regulatory levels for drinking water or levels that are protective of aquatic organisms in Railroad Creek (into which groundwater eventually discharges) for aluminum, cadmium, copper, iron, lead, and/or zinc at a number of locations at the Site, most notably from the Main Portal, seeps, Tailings Piles 1, 2, and 3, the East and West Waste Rock Piles, the Honeymoon Heights Waste Rock Piles, and the Lower West Area. Tables 2 and 3 show screening levels (chemical-specific ARARs) and Table 4 shows the concentrations of contaminants of concern in groundwater at various areas of the Site.

In general, groundwater concentrations vary seasonally and are lower in the fall and higher in the spring. Seasonally the concentrations of several contaminants in groundwater that discharge to surface water exceed water quality criteria for protection of aquatic life by factors of 100 to over 10,000 in several areas.

Varying groundwater flow conditions affect the quality of water that discharges into Railroad Creek, as indicated by Intalco's flow tube analysis for data collected during the RI. Figures 7 and 8 show the location of seeps and groundwater discharge zones (referred to as flow tubes) and Figures 9, 10, and 11 indicate the associated exceedances of screening levels. For some constituents, surface water background concentrations exceed the screening levels and, therefore, are appropriate to consider for protection of aquatic life where hazardous substances are released into Railroad Creek. Groundwater with concentrations of hazardous substances above protective levels continues to discharge into Railroad Creek downgradient of the tailings piles, as shown on Figure 12. Surface water protection levels (based on the protection of aquatic life) are significantly lower (i.e., lower by orders of magnitude) than groundwater standards for protection of human health (e.g., compare Tables 2 and 3).

5.3.2 Surface Water

Surface water in Railroad Creek is impacted by groundwater discharge, including groundwater from the Main Portal (AMD), and contact with tailings and discrete seeps (ARD) (see Figure 13). Groundwater draining from the Main Portal discharges into Railroad Creek and contains concentrations of hazardous substances that exceed state and federal chronic toxicity water quality criteria for the protection of aquatic life. Table 5 presents spring and fall surface water contaminants of concern at several locations along Railroad Creek. Water quality at sampling locations beginning in the reach adjacent to the Lower West Area and extending downstream to the mouth of the creek at Lake Chelan has exceeded screening levels for protection of aquatic life for aluminum, cadmium, copper, iron, lead, and/or zinc.

In general, concentrations are lower in the fall and higher in the spring when concentrations of copper exceed chronic screening levels (i.e., the NWQC) by factors of 8 to 30, cadmium by factors of 5 to 15, and zinc concentrations exceed the NWQC by factors of 3 to 8 at various Railroad Creek sampling locations. Details are shown by comparison of Tables 3 and 5. Elevated hazardous substance concentrations and exceedances of screening criteria for protection of aquatic life were observed at all monitoring locations along an approximately 10-mile stretch of Railroad Creek downgradient of the tailings piles to Lake Chelan. Aquatic life, including both fish and benthic macroinvertebrates, have been heavily impacted for several miles downgradient of the tailings piles, and the population of the benthic macroinvertebrates do not fully recover to the same population abundance and diversity as upgradient of the Site before entering Lake Chelan (URS 2004).

Surface water in the Copper Creek Diversion (the tailrace channel from the Holden Village hydroelectric plant that discharges to Railroad Creek) has seasonal exceedances of the NWQC (both chronic and acute) for cadmium and the Washington surface water quality standards (WAC 173-201A) for copper, and zinc (Table 5). Concentrations of hazardous substances in the main stem of Copper Creek are at or below state and federal water quality criteria for the protection of aquatic life.

Surface water quality at the Site does not exceed state and federal drinking water criteria.

5.3.3 Sediment

Iron precipitates have formed in Railroad Creek from the release of ferric sulfate and other hazardous substances from the tailings piles. Observed effects include ferricrete and iron and aluminum flocculent, which fills interstitial pore space in the sediment and coats gravel, cobbles, and boulders in the stream channel. The ferricrete and flocculent have caused damage to the aquatic habitat.

Releases from the Site have resulted in concentrations of hazardous substances in sediment in Railroad Creek and the Lucerne Bar that exceed values considered by the state to be protective for freshwater sediment for a number of hazardous substances (Table 6). COCs for sediment include aluminum, cadmium, chromium, copper, iron, silver, and zinc. COCs listed in Table 6 are based on comparison to risk-based criteria that were identified in Table 11 of the Proposed Plan. Ecology is currently developing new freshwater sediment guidance and will in the future rely on freshwater bioassays to assess toxicity for mine sites and other sites with particular geochemical characteristics (Ecology 2011). Criteria for bioassays that will be used for monitoring at Holden are presented in Table 7.

5.3.4 Soil

Soil at the Site is impacted by releases from past mining activities and contains concentrations of hazardous substances that exceed regulatory levels for the protection of human health or the environment (via ingestion, dermal absorption, and inhalation). In addition, leachate from tailings piles has resulted in high concentrations of hazardous substances impacting pore water in shallow soil (see Figure 12) that drains to surface water. Concentrations of these contaminants of concern are summarized for each AOI in Table 8. The primary contaminants of concern include aluminum, arsenic, cadmium, copper, and lead. Soil in the Lagoon Area and Maintenance Yard is also impacted by petroleum hydrocarbons such as gasoline, diesel fuel, or heavy oils. Terrestrial hazard quotients range up to 300 times the screening level.

5.3.5 Air

Historically, wind-blown tailings expanded the Site footprint, were a nuisance, and posed possible health risks at the Site, but this pathway was largely addressed by actions taken by the Forest Service in 1989–1991. The Forest Service conducted an air quality study in 1994 and identified concentrations of airborne CPOCs were well below EPA risk-based concentrations. The human health risk assessment (HHRA) performed as part of the DRI concluded the inhalation pathway is incomplete and, therefore, there are no significant human health risks related to the soil to air pathway (provided a cap is maintained on the tailings to prevent generation of wind-blown tailings).

6.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

6.1 Current Land Use

The Site is situated on National Forest System land administered by the Okanogan-Wenatchee National Forest, with the exception of the patented mining and mill site claims (private land) owned by Holden Village, as shown on Figure 4. At Lucerne there are also residences located on privately owned land.

The current land uses at site AOIs include the following:

- **Holden Village.** Approximately 60 people reside at Holden Village year-round and approximately 5,000 people reportedly visit the facility each year. Holden Village is a Lutheran ministry and community that provides visitors with spiritual and educational programs. Facilities at the Holden Village include buildings, access roads and paths, and maintained landscaping.

- **Tailings Piles 1, 2, and 3.** The emergency evacuation area for the Holden Village is located on Tailings Pile 1. The tailings piles are also visited occasionally for access to hiking trails, and other light recreational use such as frisbee golf.

- **East and West Waste Rock Piles.** The top surface of the West Waste Rock Pile is currently used by the Holden Village to store miscellaneous recyclable materials and is infrequently visited by hikers. The East Waste Rock Pile is used to a lesser extent than the West Waste Rock Pile.

- **Honeymoon Heights Waste Rock Piles.** The Honeymoon Heights Waste Rock Piles are not routinely used; however, hikers may occasionally visit these waste rock piles on hiking trails.

- **Areas downslope of Honeymoon Heights Waste Rock Piles.** The areas downslope of Honeymoon Heights Waste Rock Piles are not currently used with the exception of a hiking trail that passes beneath the 1100 Level and 800 Level waste rock piles.

- **Former Ventilator Portal Surface Water Retention Area.** The former Ventilator Portal Surface Water Retention Area is not currently used.

- **Lower West Area.** The Lower West Area is bisected by a road providing the primary access to the maintenance yard, composting area, and site features associated with mine operations (waste rock piles, former Mill Building, 1500 Level Main Portal, and tailings piles). Large vehicle traffic regularly occurs through the Lower West Area. Holden Village operates a firewood cutting/storage yard and hydroelectric power plant in the eastern portion of the Lower West Area.

- **Lagoon Area.** The Lagoon Area is not currently used, other than for occasional vehicle storage in the flat area immediately north of the Lagoon.

- **Maintenance Yard.** The Maintenance Yard is currently used by the Holden Village for equipment maintenance and storage and includes two maintenance buildings.

- **Wind-Blown Tailings Area.** The Lucerne-Holden Road crosses the Wind-Blown Tailings Area and sustains limited daily vehicle traffic. The Holden Village operates a septic system in the Wind-Blown Tailings Area. Hikers and other recreational users also use or cross the Wind-Blown Tailings Area to access Railroad Creek and a footbridge crossing Railroad Creek east of Tailings Pile 3.

- **Ballfield Area/Wilderness Boundary.** The Ballfield Area is occasionally used by the Holden Village for community activities. The wilderness boundary area near the Ballfield Area is used by hikers and campers, and a campground is maintained in this area by the Forest Service. A hiking trail passes along the south edge of the ballfield.

6.2 Anticipated Future Land Use

Anticipated future land use at the Site is expected to be generally consistent with current land use (recreational) for the majority of the Site (and residential within Holden Village). Following remedy implementation, some site features may no longer exist (e.g., features that are removed or covered) and some areas of the Site may have new or modified uses, such as areas where groundwater collection or water treatment systems operate, and disposal areas for treatment system residues.

The Agencies anticipate that Holden Village will continue to occupy the former company town under a Special Use Permit from the Forest Service, during and after implementation of the cleanup action.

The Agencies anticipate that the National Forest portion of the Site and adjacent National Forest System land will continue to be managed as part of the National Forest following implementation of the remedy, including the Glacier Peak Wilderness, which generally bounds the Site to the west, north, and south. The Railroad Creek valley has historically provided habitat to spotted owls, lynx, grizzly bears, gray wolves, and other potentially threatened or endangered species, although no threatened or endangered species have been observed at the Holden Mine Site (personal communication, M. Lenz, Forest Service).

The Agencies expect the Railroad Creek Watershed will continue to be occupied by a hundred or fewer permanent residents, along with seasonal visitors on the order of 5,000 to 10,000 persons each year.

6.3 Surface Water and Groundwater Uses

The beneficial uses of groundwater at the Site are as a potential source of drinking water for residents and visitors, and as a source of recharge to local surface water bodies including Railroad Creek. Groundwater at and near the mine is not currently used for drinking water for residents and visitors, who get their drinking water from Copper Creek upstream of the Site. Groundwater is used as a source of drinking water at Lucerne, which is downgradient of the mine. Lucerne is considered part of the Site, since hazardous substances in Railroad Creek that exceed cleanup levels extend the entire way to Lake Chelan.

Groundwater also discharges to local surface water bodies, including Railroad Creek.

The designated beneficial uses of surface water (i.e., Railroad Creek) are aquatic life (salmonid spawning, rearing, migration, and core summer habitat), recreation (extraordinary primary contact), water supply (domestic, industrial, agricultural, and stock watering), and miscellaneous (wildlife habitat, harvesting, commerce and navigation, boating, and aesthetic value) [see WAC 173-201A-600].

The Site consists of lands that are administered by the Forest Service in accordance with the Forest Plan (Forest Service 1990 as amended), except for a limited area of about 235 acres that are patented mining claims owned by Holden Village. Since 1961, Holden Village has operated on National Forest System land under a Special Use Permit issued by the Forest Service, and on Holden Village land. Holden Village obtains its drinking water from Copper Creek upstream of the area impacted by releases from the mine. As a result, anticipated future uses of surface water and groundwater at the Site are expected to be the same as the current uses.

7.0 SUMMARY OF RISKS

This section provides a summary of human health and ecological risks at the Site. It also identifies the basis for taking action at the Site.

The major sources of information used to assess site risks due to contaminants of potential concern (COPCs) include the Draft Remedial Investigation Report (Dames & Moore 1999), U.S. Fish and Wildlife Service documents (USFWS 2004, 2005, and 2007a), the SFS (Forest Service 2007), and the Terrestrial Ecological Evaluation Report (ERM 2008 and 2009). Information from these sources was used to identify contaminants of concern (COCs) and develop risk-based cleanup levels (CULs) using risk-based published standards and site-specific, risk-based calculations, as appropriate.

7.1 Overview of Risk Assessment and Cleanup Level Process

This overview provides a road map of the risk assessment and cleanup level process used in this ROD. This process follows the Washington State MTCA cleanup regulation paradigm for developing cleanup standards (Chapter 173-340 WAC) and identifying risks. This process involves comparisons of media concentrations to risk-based concentrations (RBCs) to characterize Site risks. The scientific approach for deriving the MTCA RBCs is virtually identical to the baseline risk assessment methodology described in CERCLA guidance (e.g., Risk Assessment Guidance for Superfund [EPA 1989]). For example, the MTCA Method B levels (i.e., RBCs) for the protection of human health use the same exposure factors and toxicity values as used in a baseline risk assessment performed using the EPA guidance.

The risk assessment and cleanup selection process used at this Site involves the following steps:

- The first step is the identification of contaminants of potential concern (COPCs). COPCs are constituents that may pose unacceptable risk to human health or the environment.

- The second step is the identification of COCs. COCs are hazardous substances that pose unacceptable risks to human health or the environment. COCs are identified as constituents with concentrations in site media (soil [including natural soil, mine tailings, and waste rock], groundwater, surface water, and sediment) that exceed the RBCs protective of human health and/or the environment and the background concentration.

- The final step of the process is the derivation of cleanup levels (CULs). The CUL is the higher of the RBC or background concentration because the CUL cannot be set at a concentration below background.[7]

These steps are described in the following subsections.

7.1.1 Identification of Contaminants of Potential Concern

The SFS (Forest Service 2007) identified COPCs for the Site, which were subsequently refined in the ASFS (Forest Service 2010a). COPCs were identified by comparing constituent concentrations measured in environmental media (i.e., soil and/or mine tailings, groundwater, surface water, and sediment) to chemical-specific criteria. These criteria are primarily RBCs selected to be protective of human health and the environment. For example, the criteria for soil include MTCA Method B levels protective of human health via the soil ingestion and dermal contact pathways, as well as protection of human health via the ingestion of groundwater pathway (see Table 8 in Forest Service 2007). The MTCA

[7] These cleanup levels were used as the screening levels referred to in Section 5.3.

Method B levels for human health were derived using exposure factors and toxicity values (carcinogenic and non-carcinogenic) protective of unrestricted land use. The screening levels used to identify COPCs were also used to identify COCs and, ultimately, were used in the selection of CULs.

7.1.2 Derivation of Risk-based Concentrations

The RBCs were developed for each environmental media of concern (i.e., groundwater, surface water, sediment, and soil) to be protective of human health and the environment.

Human health RBCs for groundwater are the lowest chemical-specific criteria shown in Table 2. The criteria include federal and state Maximum Contaminant Levels (MCLs), non-zero MCL Goals (MCLGs), and state MTCA Method A and B levels for the drinking water pathway. These criteria are risk-based and were developed using exposure factors and toxicity values protective of public consumption of drinking water. Although ecological receptors are not expected to be directly exposed to constituents in groundwater, aquatic receptors (e.g., fish, aquatic invertebrates) would be exposed to groundwater that discharges to surface water. Where this occurs, the surface water RBCs (i.e., chemical-specific criteria) listed in Table 3 also apply to groundwater.

RBCs for surface water are the criteria shown as the lowest chemical-specific criteria for the protection of human health and the environment shown in Table 3. These include federal and state surface water quality standards and criteria, MTCA Method B levels, and MCLs for drinking water which are risk-based. For example, state and federal water quality standards/criteria for protection of aquatic organisms are based on results of laboratory toxicity tests on a large number of different organisms (e.g., fish, aquatic invertebrates, amphibians, algae) that ensure the protection of aquatic organisms. Exposure pathways addressed by these RBCs include direct contact by aquatic organisms and human ingestion of water and aquatic organisms that accumulate constituents from water.

The sediment RBCs were the lowest chemical-specific criteria based on TBCs shown in Table 11 of the Proposed Plan. The criteria listed in that table are risk-based concentrations derived from toxicity test studies conducted primarily on aquatic invertebrates. These aquatic invertebrates typically live on or in the sediment and, therefore, are highly exposed to constituents in the sediment. Exposure pathways addressed by the criteria include direct contact and ingestion of sediment by aquatic organisms.

Human health RBCs for soil were developed using MTCA methods for three pathways: soil ingestion only, soil ingestion and dermal contact, and protection of groundwater (Table 9). The MTCA Method B levels were derived using standard formulas, exposure factors, and toxicity values (both carcinogenic and non-carcinogenic) protective of unrestricted (i.e., residential) land use. The standard Method B procedures use an acceptable cancer risk level of 1 in 1,000,000 and an acceptable hazard quotient (HQ) of 1 for non-carcinogens.[8] MTCA Method A levels (Table 9) were used as the human health-based soil RBC when a Method B level was unavailable, which only occurred for lead and petroleum hydrocarbon compounds.

Ecological RBCs for soil are identified in Appendix E of the ASFS (Forest Service 2010a). These RBCs are protective of three broad groups of ecological receptors: plants, soil invertebrates, and wildlife (e.g., birds and mammals). The RBCs for plants and soil invertebrates generally came from two published sources: MTCA ecological indicator soil concentrations (EISCs) (Table 749-3 of MTCA) and EPA's ecological soil screening levels (Eco-SSLs).[9] The EISCs and Eco-SSLs for plants and soil invertebrates were derived from published toxicity studies on a variety of test species; are assumed to be protective of all species in each of these groups; and address the direct contact pathway for plants and direct contact/soil ingestion pathways for soil invertebrates. In addition to the EISCs and Eco-SSLs, soil RBCs for several constituents were developed using site-specific information. Site-specific RBCs were developed for:

- Plants, for aluminum, copper, lead, molybdenum, and thallium; and
- Soil invertebrates, for copper and mercury.

Wildlife RBCs for soil were primarily developed using site-specific data (i.e., concentrations of contaminants in tissue from plant and soil invertebrates collected from the Site) and exposure models for six surrogate species: the vole, hare, deer, shrew, robin, and grouse. These six species represent different feeding guilds (i.e., herbivores and insectivores) that are highly exposed to soil

---

[8] The MTCA acceptable hazard quotient (HQ) of 1 is equivalent to EPA's acceptable hazard quotient, and the MTCA acceptable cancer risk level of 1 in 1,000,000 falls within EPA's acceptable risk range of 1 in 1,000,000 to 1 in 10,000 (see EPA OSWER Directive 9355.0-30).

[9] Available online at http://www.epa.gov/ecotox/ecossl/.

contaminants. Therefore, it is assumed that if these surrogate species are not at risk, wildlife (e.g., all birds and mammals) in general are protected. The exposure parameters and toxicity values used to derive the wildlife RBCs primarily came from MTCA (Table 749-5) and EPA's Eco-SSLs. Since plant and soil invertebrate tissue samples were not collected from the Lagoon, Maintenance Yard, or Ventilator Portal Surface Water Retention Area, it was not possible to derive site-specific wildlife RBCs for these AOIs. For these three areas, MTCA default wildlife EISCs were used as the RBCs. The wildlife RBCs address two exposure pathways: ingestion of soil and ingestion of plants or soil invertebrates that accumulate constituents from soil.

7.1.3 Identification of Contaminants of Concern

In general, COCs for each media and area of concern were identified by comparing media constituent concentrations from the Site to the RBCs (see Section 7.1.2) and background concentrations, when available. As described later in this subsection, several additional factors were also considered in the identification of soil COCs for terrestrial ecological receptors at several AOIs.

Groundwater COCs protective of humans drinking groundwater are identified in Table 4. Since ecological RBCs and background concentrations are not available for Site groundwater, the COCs shown in Table 4 were selected by comparing the 95 percent upper confidence level (95 UCL) constituent concentrations from each area of interest for the spring and fall periods to the human health RBC. COCs for the protection of groundwater discharging to surface water can be identified by comparing the Site concentrations shown in Table 4 to the RBCs protective of surface water receptors shown in Table 3.

Surface water COCs are identified in Table 5. These COCs were identified by comparing the 95 UCL constituent concentrations from samples collected in the spring and fall from five locations on Railroad Creek and two locations on Copper Creek to RBCs and background concentrations shown in Table 3. These RBCs are protective of aquatic organisms (e.g., fish, aquatic invertebrates, algae) and human consumption of water and organisms that accumulate constituents from the surface water.

Sediment COCs are identified in Table 6. These COCs were identified by comparing detected constituent concentrations at each sediment sampling location to the RBCs listed in Table 11 of the Proposed Plan. The ecological RBCs listed in Table 11 of the Proposed Plan were used to identify COCs.

Bioassays will be required in the future to confirm whether concentrations of COCs in sediment at the Site are protective (see Ecology 2011).

Human health-based COCs for soil are identified in Table 10. These COCs were identified by comparing the 95 UCL constituent concentration for each area of interest to the human health RBCs and background concentrations shown in Table 9.

Soil COCs for the protection of terrestrial ecological organisms were identified by first comparing COPC concentrations at each AOI to ecological RBCs. (Identification of COPCs is described above in Section 7.1.2). Those COPCs having HQs of one or less and/or whose concentrations did not exceed background levels (shown in Table 9), were not carried forward as COCs. In response to comments received on the Proposed Plan, the Agencies further refined the resulting list of COCs for several AOIs where additional data were available. These AOIs were the Wind-blown Tailings Area, Holden Village, the Ballfield Area, Honeymoon Heights Waste Rock Piles, the Areas Downslope from the Honeymoon Heights Waste Rock Piles, and the Lower West Area-East. The Agencies' additional evaluation involved comparison of plant and invertebrate tissue concentrations to tissue-based TRVs (presented in the ASFS) and to tissue background concentrations (presented in ERM 2009). Constituents whose concentrations in tissue did not exceed tissue-based TRVs and/or tissue background concentrations were not carried forward as COCs. The Agencies' evaluation also took into account the role of pH in the toxicity of aluminum. At AOIs where soil pH exceeded 5.5, aluminum was not carried forward as a COC because of its decreased toxicity. The Agencies' additional evaluation of COCs is detailed in Houkal and Dagel (2011). The final list of soil COCs for the protection of terrestrial ecological organisms is shown in Table 11.

7.1.4 Derivation of Cleanup Levels

Table 11 presents the CULs for groundwater, surface water, and soil. CULs were identified by first selecting the lower of the human health and ecological RBCs, when both are available. If the selected RBC protective of human health and the environment is above the background concentration, the CUL is the RBC. If the RBC is less than the background concentration, the CUL is set to the background concentration.

Table 11 does not list numeric CULs for sediment because the protectiveness of the remedy will be determined based on sediment bioassay results.

7.1.5 Examples of Cleanup Level Derivation and Risk Characterization

Four examples are provided below showing how the CULs identified in Table 11 were derived and how exceedances of these CULs relate to quantitative measures of risk. These examples include CULs for soil, groundwater, and surface water (Table 11).

The first step of the CUL derivation process is the selection of an RBC protective of human health and the environment. The lowest human health and ecological RBCs is the final RBC. In the second step of the process, the final RBC is compared to the background concentration and the higher of the two concentrations is selected as the CUL.

Example 1. Arsenic in soil at the Areas Downslope of Honeymoon Heights

- Step 1. Select RBC
  - The human health RBC is 0.62 mg/kg (Table 9).
    - This RBC is the MTCA Method B level for soil ingestion and dermal contact. Arsenic is a carcinogen and the Method B target risk is 1 in 1,000,000. The 95 UCL for arsenic in soil at the Areas Downslope of Honeymoon Heights is 20 mg/kg (Table 10), so the cancer risk is 1 in 68,000. Therefore, there is an unacceptable health risk from arsenic.
  - The ecological RBC is 18 mg/kg (ASFS Table 9, Forest Service 2010a).
    - This RBC is the lowest of the RBCs for plants (18 mg/kg), soil invertebrates (60 mg/kg), and wildlife (132 mg/kg). The 95 UCL for arsenic in soil is 20 mg/kg (Table 10), so the HQs are 1 plants, 0.3 invertebrates, 0.2 wildlife (Table 12). Therefore, there is no unacceptable ecological risk from arsenic.
  - The final RBC is 0.62 mg/kg.
- Step 2. Identify CUL
  - Areas Downslope of Honeymoon Heights is riparian habitat, with a background concentration of 16 mg/kg (Table 9).
  - Since the RBC is below background, the CUL is set at the background concentration of 16 mg/kg (Table 11).

Example 2. Copper in soil at Tailings Piles 1, 2, and 3

- Step 1. Select RBC
  - The human health RBC is 2,700 mg/kg (Table 9).
    - This RBC is the MTCA Method B level for soil ingestion and dermal contact. Copper is a non-carcinogen and the Method B target HQ is 1. The 95 UCL is for copper in soil at Tailings Piles 1, 2, and 3 is 865

mg/kg (Table 10), so the HQ is 0.32. Therefore, there is no unacceptable human health risk from copper.

- The ecological RBC is 85 mg/kg (ASFS Table 9) (Forest Service 2010a).
  - o This RBC is the lowest of the RBCs from among plants (113 mg/kg), soil invertebrates (85 mg/kg), and wildlife (208 mg/kg). The 95 UCL for copper is 865 mg/kg (Table 10), so the HQs are 8 plants, 10 inverts, and 4 wildlife (Table 12). Therefore, there is an unacceptable risk to plants, invertebrates, and wildlife from copper.
- The final RBC is 85 mg/kg.

■ Step 2. Identify CUL
- Tailings Piles 1, 2, and 3 are mixed conifer habitat with a background concentration of 45 mg/kg (Table 9).
- Since the RBC is above background, the CUL is set at the RBC of 85 mg/kg (Table 11).

Example 3. Zinc in groundwater at the East and West Waste Rock Piles

■ Step 1. Select RBC
- The human health RBC is 4,800 ug/L (Table 2).
  - o This RBC is the MTCA Method B level for drinking water. Zinc is a non-carcinogen and Method B target HQ is 1. Concentrations of zinc in groundwater are 9,270 ug/L in spring and 8,960 ug/L in fall (Table 4), so the HQs are 2 for spring and fall. Therefore, there is unacceptable health risk from zinc.
- The ecological RBC is 13.6 ug/L (Table 3). Concentrations of zinc in groundwater are 9,270 ug/L in spring and 8,960 ug/L in fall (Table 4), so the HQs would be roughly 700 for spring and fall. Therefore, there would be unacceptable risk to aquatic organisms from zinc should groundwater discharge to surface water at these concentrations.
- The final RBC is 4,800 ug/L for groundwater not entering surface water and 13.6 ug/L for groundwater entering surface water.

- Identify CUL
  - The background level for zinc in surface water is 9.8 ug/L.
  - The CUL is the higher of the RBC or background and is set at 4,800 ug/L for groundwater used as drinking water and 13.6 ug/L for groundwater entering surface water (Table 11).

Example 4. Aluminum in surface water in Railroad Creek

■ Step 1. Select RBC
- A human health RBC is not available (Table 2).
- The ecological RBC is 87 ug/L (Table 3).

    - This RBC is the chronic state water quality standard and is intended to be protective of aquatic organisms. Surface water concentrations at several locations on Railroad Creek have aluminum concentrations above the RBC (Table 5). The maximum aluminum concentration in surface water samples from Railroad Creek is 246 ug/L (Table 5), which equates to a HQ of 3. Therefore, there is unacceptable ecological risk from aluminum.
  - The final RBC is 87 ug/L.
- Step 2. Identify CUL
  - The background concentration is 152 ug/L (Table 3).
  - Since the RBC is below background, the CUL is set at the background concentration of 152 ug/L (Table 11).

7.2 Human Health Risk

Humans potentially exposed to hazardous substances at the Site include Holden Village residents and visitors, other visitors to the National Forest, cleanup workers, and Agencies personnel. Table 1 presents a summary of the COCs including the minimum and maximum detected concentrations in different media at the Site, and the exposure point concentration, based on the 95 UCL.

Important exposure pathways by which humans may become exposed to hazardous substances at the Site include:[10]

- Ingestion of and dermal contact with soil; and
- Ingestion of groundwater.

7.2.1 Soil

Table 9 presents chemical-specific criteria and background concentrations for soil that were used to derive cleanup levels. Soil COCs include twelve metals, arsenic, and three petroleum hydrocarbon mixtures. Reasonable maximum

[10] Inhalation of airborne contaminants is not considered an important exposure pathway under existing conditions. Data from an air quality study conducted by the Forest Service in 1994 indicated that concentrations of airborne COPCs were well below EPA risk-based concentrations and that no additional air monitoring was required to address this pathway (Tetra Tech 1996).

exposure point concentrations of COCs in soil for areas of interest are shown in Table 10.

Soil concentrations of arsenic, cadmium, copper, lead, zinc, gasoline- and diesel-range hydrocarbons, and/or heavy oil-range hydrocarbons at some areas of interest exceed soil levels protective of human health from direct contact or ingestion. These areas include the Honeymoon Heights Waste Rock Piles and areas downslope; the Lower West Area, including soil in the Lagoon Area; and the Holden Village Maintenance Yard.

Soil concentrations of arsenic, cadmium, copper, mercury, selenium, silver, thallium, zinc, gasoline- and diesel-range hydrocarbons, and/or heavy oil-range hydrocarbons in some areas of interest also exceed soil levels protective of groundwater potentially used as a drinking water source. These areas include the areas listed above, as well as the tailings piles, main waste rock piles, and the Ventilator Portal Surface Water Retention Area.

7.2.2 Groundwater

Table 2 presents chemical-specific criteria and background concentrations for groundwater that were used to derive cleanup levels for protection of human health. As mentioned above in Section 7.1.2, these criteria include federal and state MCLs, non-zero MCL Goals (MCLGs), and state MTCA Method A and B levels for the drinking water pathway. Groundwater COCs include aluminum, cadmium, copper, lead, and zinc. Reasonable maximum exposure point concentrations for groundwater COCs in areas of interest are shown in Table 4.

Concentrations of aluminum, cadmium, copper, lead, and/or zinc in groundwater exceed cleanup levels for protection of human health in the Honeymoon Heights Waste Rock Piles, Mine Portal discharge, Lower West Area, East and West Waste Rock Piles, former Mill Building, and Tailings Piles.

7.3 Ecological Risks

Ecological receptors at the Site include aquatic organisms in Railroad Creek and terrestrial organisms, including plants, soil invertebrates, and wildlife.

Endangered Species Act (ESA)-listed threatened or endangered species including bull trout, Canada lynx, gray wolf, grizzly bear, marbled murrelet, northern spotted owl, showy stickseed, Wenatchee Mountains checker-mallow, and Ute ladies' tresses occur—or may occur—in Chelan County. Portions of Chelan

County are designated as critical habitat for bull trout, Canada lynx, Northern spotted owl, and Wenatchee Mountains Checkermallow. In addition, several USFWS candidate species or Species of Concern (USFWS 2010) are also present in the Railroad Creek valley, including wolverine, bald eagle, northern goshawk, Western gray squirrel, and Westslope cutthroat trout. The Railroad Creek valley has historically provided habitat to spotted owls, lynx, grizzly bears, gray wolves, and other potentially threatened or endangered species, although no threatened or endangered species have been observed at the Holden Mine Site (personal communication, M. Lenz, Forest Service). Table 1 presents a summary of the COCs including the minimum and maximum detected concentrations in different media at the Site, and the exposure point concentration, based on the 95 UCL. Table 13 presents a summary of the ecological exposure pathways of concern.

Important exposure pathways by which ecological receptors may become exposed to hazardous substances at the Site include:

- Ingestion of plants and soil invertebrates by wildlife;
- Dermal contact with soil by plants and invertebrates; and
- Ingestion of soil by soil invertebrates and wildlife.

Potential ecological risks at the Site are summarized in the following subsections.

7.3.1 Surface Water

Table 3 presents chemical-specific criteria and background concentrations for surface water that were used to derive cleanup levels for protection of aquatic receptors. Reasonable maximum exposure point concentrations of COCs in surface water collected from Railroad Creek and at the confluence of Copper Creek with Railroad Creek are shown in Table 5.

Surface water COCs include aluminum, cadmium, copper, iron, lead, and zinc. Concentrations of COCs exceed the surface water criteria that are protective of aquatic biota.

Risks for trout exist in surface water at the Site, primarily from dissolved copper, based on HQs for dissolved copper in surface water samples that ranged from 18 to 26 (Dames & Moore 1999). In addition, based on published scientific studies cited in USFWS (2004 and 2005), surface water concentrations of aluminum, cadmium, copper, and zinc exceed levels known to be toxic to trout and other salmonids. Iron concentrations in surface water at the Site also have adverse effects on both fish and benthic macroinvertebrates (USFWS 2005).

7.3.2 Sediment

There currently are no promulgated federal or state freshwater sediment standards applicable to the Site. Proposed risk-based screening levels for sediment were presented in the Proposed Plan based on documents prepared by Ecology and others (Michelsen 2003; USACE et al., 2006; Ingersoll et al., 1996; Persaud et al., 1993; and Cubbage et al., 1997). Based on comparison to these screening levels, COCs for sediment include aluminum, beryllium, cadmium, chromium, copper, iron, and zinc, as shown in Table 6.

7.3.3 Soil

A summary of terrestrial ecological HQs for each COC in soil at the Site is presented in Table 12. HQs were calculated by dividing the reasonable maximum exposure point concentrations of COCs in soil (see Table 8) by the ecologically protective risk-based soil concentrations that are presented in the final Feasibility Study (see Appendix E of the ASFS).

- Risks for plants and soil macroinvertebrates result from hazardous substance concentrations in soil in almost all areas of the Site, with HQ values ranging to more than 100.

- Birds and mammals may be subject to toxicity effects from feeding in Site areas where the highest hazardous substance concentrations were measured (where HQs ranged to more than 100).

The following subsections describe risks shown in Table 12 for each area of interest.

Tailings Piles 1, 2, and 3

The tailings piles have concentrations of copper and zinc that produce HQs greater than 1 for plants and soil invertebrates. HQs for cadmium, copper, thallium, and zinc range from 4 to 40 for wildlife species (i.e., vole, shrew, hare, deer, robin, and grouse). Tailings are a source of risk to aquatic receptors (e.g., fish and invertebrates) through the soil to groundwater to surface water pathway, and where reactive tailings are released into Railroad or Copper Creeks through erosion or slope instability.

East and West Waste Rock Piles

Waste rock in the East and West Waste Rock Piles has concentrations of copper, lead, molybdenum, and zinc that produce HQ values greater than 1 for plants and/or soil invertebrates. HQs for barium, chromium, copper, lead, molybdenum, thallium, and zinc range from 2 to 60 for wildlife species. (i.e., vole, shrew, hare, deer, robin, and grouse).

Honeymoon Heights Waste Rock Piles

The waste rock in the Honeymoon Heights Waste Rock Piles has concentrations of various hazardous substances that produce HQ values greater than 1 for plants and soil invertebrates. HQs for barium, copper, lead, molybdenum, silver, and thallium range from 2 to 200 for wildlife species (i.e., vole, shrew, hare, deer, robin, and grouse).

Areas Downslope from the Honeymoon Heights Waste Rock Piles (DSHH)

The DSHH has concentrations of various hazardous substances that produce HQ values greater than 1 for plants[11] and soil invertebrates. HQs for aluminum, barium, copper, and thallium range from 2 to 70 for wildlife species (i.e., vole, shrew, hare, deer, robin, and grouse).

Ballfield Area

Soil at the Ballfield Area has concentrations of copper that produce an HQ value of 2 for soil invertebrates.

Holden Village

Soil at Holden Village produces HQs of 3 to 4 for plants and wildlife (i.e., vole, shrew, robin, and grouse)from aluminum, HQs of 2 for plants and invertebrates from copper, and an HQ of 2 for invertebrates from zinc.

---

[11] Recent analysis of site-specific plant tissue data (Houkal and Dagel 2011) showed that for copper, only, the conifer and grass plant groups are at risk.

Lower West Area

Soil in the Lower West Area-East has HQs for plants[12], soil invertebrates, and wildlife species (i.e., vole, shrew, hare, deer, robin, and grouse) for several contaminants ranging from 2 to 100.

Soil in the Lower West Area-West (other than the Lagoon Area) does not have HQs greater than 1 for terrestrial ecological receptors (i.e., plants, soil biota, and wildlife).

Lagoon Area

Soil within the Lagoon Area has HQs for a number of contaminants (including petroleum hydrocarbons) of 2 to over 100 for plants, soil invertebrates, and wildlife species.

Wind-Blown Tailings Area

Soil within the Wind-Blown Tailings Area produces an HQ of 3 for plants from molybdenum.

Maintenance Yard

Soil at the Maintenance Yard has concentrations of hazardous substances that produce HQs for a number of contaminants (including petroleum hydrocarbons) of 2 to over 100 for plants, soil invertebrates, and wildlife species.

Former Mill Building

Soil in the former Mill Building area has not been characterized because of safety concerns associated with the derelict structure. Sources of contamination within the former Mill Building likely include unprocessed ore, mineral concentrates (processing residuals), and mineral salts present on the surface and in abandoned equipment. The presence of potential hazardous substances in

[12] Recent analysis of site-specific plant tissue data (Houkal and Dagel 2011) showed that for aluminum, only, the conifer and grass plant groups are at risk; for copper, only, the shrub plant group is at risk; and for molybdenum, only, the shrub and grass plant groups are at risk.

the former mill is inferred from groundwater seeps from the mill area that have concentrations of several hazardous substances above state and federal criteria for the protection of aquatic life, and cadmium and copper concentrations above drinking water criteria.

Ventilator Portal Surface Water Retention Area

Soil within the Ventilator Portal Surface Water Retention Area has HQs for aluminum, barium, copper, and zinc of 2 to over 100 for plants, soil invertebrates, and/or wildlife species.

7.4 Basis for Action

Contamination at the Site presents an unacceptable risk to human health and the environment. Human receptors may be harmed by exposure to hazardous substances present in soil that pose risks in excess of a HQ of 1 and in groundwater above the MCLs for cadmium, copper, and lead. Terrestrial and aquatic ecological receptors may be harmed by exposure to hazardous substances in soil, surface water, sediment, and groundwater that discharges into surface water above levels that are protective of terrestrial and aquatic life, with some metals posing potential ecological risks significantly higher than an HQ of 1 (HQs are as high as 700 for zinc). The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

A situation that may present an imminent and substantial endangerment to human health and the environment exists at the Site because of the risks from and continuing releases of hazardous substances, including:

- Tailings and waste rock (ARD) and the mine (AMD) contribute to low pH and high metals content in groundwater and surface water that causes significant contamination within the Site.

- Concentrations of hazardous substances in groundwater exceed human health-based criteria for drinking water in some portions of the Site;

- Groundwater containing concentrations of hazardous substances is above levels protective of fish and benthic macroinvertebrates, discharges into surface water;

- Where groundwater discharges to surface water, concentrations of hazardous substances in seeps and pore water discharging into Railroad Creek are above levels protective of fish and benthic macroinvertebrates;

- Concentrations of hazardous substances in surface water (Railroad Creek and the Copper Creek Diversion) are consistently above levels protective of aquatic health (fish and benthic macroinvertebrates);

- High concentrations of hazardous substances present in pore water, surface water, and sediment have reduced the populations of fish and benthic macroinvertebrates in Railroad Creek adjacent to and downstream of the mine, and have also impacted sediment at the Lucerne Bar;

- Concentrations of hazardous substances in mine tailings, waste rock, and soil at the Site exceed criteria for protection of human health, including direct contact and ingestion, and criteria for protection of the environment; and

- Tailings pile slope instability from an earthquake event or erosion presents a risk of additional hazardous substances being released into Railroad and Copper Creeks.

8.0 REMEDIAL ACTION OBJECTIVES

Proposed remedial action objectives (RAOs) have been articulated by both the Agencies and Intalco since the late 1990s. RAOs provide a general description of the goals of the overall cleanup. RAOs have been developed for protection of human health and ecological receptors. The Agencies first presented the RAOs in draft form to summarize the Agencies' goals and expectations for remedial work to address the ongoing release of hazardous substances, restore natural resources, and protect human health and the environment. (Forest Service 1999). The Agencies revised the draft RAOs as new information about the Site was developed, as provided in 40 C.F.R. § 300.430(e)(2)(i).

8.1 Remedial Action Objectives

The RAOs for the Holden Mine Site are as follows:

1. Reduce concentrations of contaminants of concern to levels that are protective of aquatic life and comply with applicable, or relevant and appropriate requirements (ARARs) in Railroad Creek and other surface waters.

2. Reduce exposure to contaminants of concern in sediment, (including the adverse effects of ferricrete on aquatic life in Railroad Creek) to protect aquatic life and comply with ARARs.

3. Prevent migration of contaminants of concern that exceed cleanup levels in groundwater (including the Main Portal discharge) from on-site waste management areas (WMAs), to protect aquatic life and comply with ARARs.

4. Reduce exposure to contaminants of concern in soil (including tailings and other wastes) to protect terrestrial organisms and comply with ARARs. Prevent future releases of tailings and other wastes into surface water to protect aquatic receptors from contaminants of concern.

5. Protect human health and comply with ARARs by reducing human exposure to contaminants of concern in soil and other wastes, controlling exposure to contaminated groundwater, and by restoring groundwater beyond the WMAs to its beneficial use as a drinking water resource.

6. Implement the remedial action in a manner that complies with ARARs and protects human health, welfare, and the environment, including the Holden Village residential community during and after construction.[13]

8.2 Basis for RAO Selection

The RAOs were selected to summarize the Agencies' goals and expectations for remedial work to significantly reduce the release of hazardous substances and protect the environment. The RAOs include improvement of surface water and sediment quality to protect aquatic receptors, cleanup of hazardous substances

[13] The Agencies understand that Holden Village has concerns for the viability of its operations in the event that remedial construction results in substantial curtailment of the Village's normal activities for more than 2 consecutive years, or a second curtailment within 5 years of the first construction period. The Agencies will strive to achieve a schedule and other aspects of the remedy that are consistent with the expressed preferences of Holden Village. Circumstances may interfere with achieving this goal, however. The Agencies have taken into account Holden Village's request for a 5-year gap between the conclusion of the first and beginning of the second phases of major construction, as described in this ROD.

in soil to protect human health and terrestrial organisms, and the cleanup of groundwater.

An important aspect of the Selected Remedy is addressing groundwater that is contaminated with hazardous substances. As discussed in Section 6.3, one of the beneficial uses for groundwater at the Site is as a potential source of drinking water. As a result, Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act are relevant and appropriate standards for groundwater cleanup.

In accordance with Section 121(d)(2)(A) of CERCLA [42 U.S.C. § 9621(d)(2)(A)], and the NCP, groundwater at the Site must be restored to meet MCLs. The NCP provides that groundwater will be returned to its beneficial uses (including MCLs) within a reasonable restoration time frame wherever practicable [40 C.F.R. § 300.430(a)(1)(iii)(F)]. Although the point of compliance for groundwater cleanup under CERCLA is generally throughout the contaminated plume[14], the NCP recognizes that remedies may involve areas where waste materials will be managed in place. Such areas are referred to as waste management areas (WMAs). As discussed in Section 2.5 of the ASFS, certain groundwater source areas at the Site will be WMAs once the remedy is implemented as shown on Figure 14. The Selected Remedy will contain and capture the groundwater within the WMA. The containment is necessary to prevent migration of the groundwater contamination that exceeds MCLs and to prevent groundwater from discharging to surface water above levels protective of receptors including aquatic life. WMA boundaries encompass the tailings piles, mill building, the main waste rock piles, and the Lower West Area that contains extensive areas of tailings. The tailings piles and the main waste rock piles will be capped, contained, and managed in accordance with ARARs (e.g., Washington's Limited Purpose Landfill regulations).

Groundwater may remain contaminated within a WMA, and cleanup levels attained at and beyond the edge of the WMA [55 Fed. Reg. 8712, 8753, March 8, 1990], so long as measures are taken to contain and prevent exposure to the contaminated groundwater, and restoration to beneficial uses remains the goal at and beyond the edge of the WMA. Therefore, the groundwater restoration RAOs do not include cleanup of groundwater to drinking water or surface water

[14] Similarly, MTCA generally requires that all groundwater throughout the Site achieve cleanup levels [WAC 173-340-720(8)(b)].

quality standards for the protection of aquatic life so long as groundwater is contained within WMAs at the Site.

Drinking water standards must be met at a point of compliance for groundwater which is at and beyond the boundary of the WMA. Without the remedy, groundwater will continue to discharge into surface water at concentrations that exceed levels protective of aquatic life.

In addition to being a potential source of drinking water, a beneficial use of groundwater at the Site is recharge to surface water to support aquatic life. Groundwater discharging through seeps, springs, or base flow that would otherwise adversely impact surface water must be managed for surface water protection.

Both CERCLA and MTCA seek to restore groundwater quality wherever practicable. CERCLA requires consideration of the state's stream classification for protection of site-specific uses that could be impacted by groundwater discharging into the surface water.[15] At a minimum, this includes preventing receptors in the creeks from being exposed to groundwater that exceeds aquatic life protection criteria and meeting drinking water standards by controlling hazardous substances before they enter the surface water (see the NCP preamble [55 Fed. Reg. 8713]).

Certain provisions of MTCA are ARARs under CERCLA. Under MTCA, a conditional POC for groundwater to meet ambient water quality standards must be as close as practicable to the source, and groundwater discharging to surface water must meet cleanup standards at or before the groundwater-surface water interface, with specific conditions that must be satisfied before a conditional POC may be established at the point(s) where groundwater enters surface water [WAC 173-340-720(8)(c)&(d)].

---

[15] In this case, the Washington State regulations [WAC 173-201A-200 and -600] require protection of Railroad Creek's and Copper Creek's designated beneficial uses. Per WAC 173-201A-600, the following are the designated beneficial uses of surface water at the Site (use categories in parentheses): aquatic life (salmonid spawning, rearing, migration, and core summer habitat), recreation (extraordinary primary contact), water supply (domestic, industrial, agricultural, and stock watering), and miscellaneous (wildlife habitat, harvesting, commerce and navigation, boating, and aesthetic value).

Based on the above, in the Selected Remedy: 1.) groundwater must meet MCLs at and beyond the boundary of the WMA, and 2.) groundwater cleanup levels must be achieved within groundwater before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates, and not simply in the surface water column after dilution has occurred. The cleanup standards that will be used to measure progress toward and compliance with the RAOs are discussed further in Section 7 and shown in Table 11.

9.0 DESCRIPTIONS OF ALTERNATIVES

This section summarizes the remedial alternatives considered by the Agencies. The alternatives that have been considered for the Site are:

- Alternatives 1 through 8 and associated sub-alternatives developed and evaluated by Intalco in the DFFS (URS 2004);
- Alternative 9, developed by Intalco (URS 2005);
- Alternatives 10, 11, and 12, developed by the Agencies and evaluated, along with Alternative 9, in the SFS (Forest Service 2007c);
- Alternative 13 was presented by Intalco (Intalco, October 2007), but was subsequently modified by Intalco and renamed Alternative 13M (ERM and URS 2009);
- Alternative 11M is a refinement of an earlier alternative, Alternative 11, which the Agencies modified in response to new information that was obtained by Intalco during its studies related to Alternative 13M; and
- Alternative 14 (the Preferred Alternative presented in the Proposed Plan), which the Agencies developed to address deficiencies in Alternative 13M. Alternatives 11M and 14 were evaluated, along with Alternative 13M, in the ASFS (Forest Service 2010b).

In considering alternatives developed for the Site, the Agencies first reviewed and considered whether the alternatives met the threshold requirements, which are the criteria specified in 42 U.S.C. § 9621(d), 40 C.F.R. § 300.430(f)(1)(i)(A) and WAC 173-340-360(2)(a) that must be satisfied for a remedial alternative to be selected as the final cleanup remedy for a site. The CERCLA threshold criteria for remedy selection are:

1) Overall protection of human health and the environment; and

2) Compliance with ARARs [except when an ARAR is waived, as allowed under 42 U.S.C. § 9621(d)(4), and 40 C.F.R. § 300.430(f)(1)(ii)(C)].

For Ecology's purposes, the threshold requirements for selecting a cleanup remedy under MTCA include that the remedy:

1) Protect human health and the environment;

2) Comply with cleanup standards;

3) Comply with applicable state and federal laws; and

4) Provide for compliance monitoring.

The DFFS presented Alternatives 1 through 8, including sub-alternatives. The Agencies' review of the DFFS concluded that Alternatives 1 through 8 did not meet the threshold criteria, based on information provided in the DFFS. In addition, the Agencies determined that the subsequent Alternatives 9 and 10 did not meet the threshold requirements.

Intalco presented Alternative 1 in the DFFS as a no-action alternative, but it included institutional controls and monitoring. The Agencies determined the alternative to be inconsistent with a no-action alternative. CERCLA requires a "no-action alternative" to be developed and considered in the analysis of the developed alternatives. Accordingly the Agencies developed Alternative 12 as a true "no-action" alternative for comparison purposes. The no-action alternative would leave the Site untouched and would not include institutional controls or long-term monitoring. Ongoing releases of hazardous substances would continue under this alternative. Existing risks caused by hazardous substances in soil, groundwater, and surface water would not be addressed except by source depletion and possibly natural attenuation that would occur gradually over a period of hundreds of years.

A summary description of Alternatives 1 through 10 is presented in Table 14. These alternatives and their sub-alternatives were not acceptable as a final remedial action (Forest Service 2007d); therefore, they were not carried forward and discussed in the comparative analysis of alternatives section of the Proposed Plan and are not formally evaluated in this ROD. Alternatives 11 and 13 were subsequently modified to 11M and 13M, respectively.

Alternatives 11M, 12 (No Action Alternative), 13M, and 14 were identified by the Agencies to be appropriate for comparison as final remedial actions and were evaluated as described in the Proposed Plan. These alternatives are described below in Section 9.1 and carried forward in their evaluation and the subsequent selection of the final remedial action selected in this ROD.

9.1 Description of Alternatives 11M, 12, 13M, and 14

The alternatives summarized in this section were carried forward and evaluated by the Agencies in the ASFS and the Proposed Plan. These alternatives were considered by the Agencies to be appropriate for comparison as a final remedial action at the Site. A comparative analysis of these alternatives is presented in Section 10 of this ROD. Table 15 provides a comparison of remedy components under Alternatives 11M, 13M, and 14.

Figures 15, 16, and 17 present the principal remedial components of Alternatives 11M, 13M, and 14, respectively. Remedy components that are common to Alternatives 11M, 13M, and 14 are discussed in Section 9.1.5.

Although the alternatives were developed with sufficient detail for evaluation and comparison, a number of design details remain that need to be determined during remedial design, including creek relocation, final slope grade and buttress design for the tailings piles, final waste rock slope grade, design of caps to isolate contaminated materials and protect plants and animals, final design of the groundwater treatment facilities, and *in situ* soil treatment (i.e., pH adjustment through lime application) where applicable.

9.1.1 Alternative 11M (Soil and Source Area Consolidation and Capping; Groundwater Collection and Treatment; Ferricrete Removal and Institutional Controls)

Estimated Capital Cost: $88,500,000

Estimated Average Annual O&M Costs: $640,000

Estimated Present Worth Costs: $120,000,000[16]

---

[16] Present worth costs are the total of capital cost and the net present value of long-term costs for operations, maintenance, and monitoring, in accordance with EPA guidance

Estimated Construction Timeframe: Three years (not including anticipated preliminary work).

Estimated Time to Achieve RAOs: Alternative 11M would protect human health and is anticipated to be protective of the environment shortly after the remedy is implemented.

Alternative 11M includes: consolidation and capping the tailings piles, waste rock piles and impacted soil; containment and collection for treatment of impacted groundwater from within designated WMAs; removal of ferricrete from Railroad Creek; *in situ* treatment by pH adjustment of some areas of impacted soil; and implementation of institutional controls.[17] Alternative 11M relies on the following treatment technologies: pH adjustment and precipitation for removal of metals from acid rock drainage; and pH adjustment to decrease the mobility and toxicity of some areas of impacted soils.

Alternative 11M would require institutional controls including a restrictive covenant on private property (e.g., the patented mining claims owned by Holden Village) and institutional controls on National Forest System land that the Forest Service will implement through the notation of restrictions in the Forest Service Land Status Records for the Okanogan-Wenatchee National Forest. These institutional controls would be required for hundreds of years to:

- Notify the public of contaminated areas that will be left on the Site, and prevent humans from direct contact with hazardous substances by warning of the risk;

- Protect the integrity of the remedy by preventing changes in Site use that would reduce effectiveness of the remedy;

(EPA 2000). The costs presented in this ROD are shown in current (2010) dollars, rounded to three significant figures. The net present value for long-term costs was calculated using a discount rate of 7 percent and a period of 50 years.

[17] *In situ* treatment would consist of application of agricultural lime (or another neutralizing agent) to raise soil pH and thereby reduce the mobility and bioavailability of hazardous substances. The methods and rate of application would be determined by treatability tests during remedial design.

- Include a requirement for consultation with the Agencies prior to changes in land use to ensure that the remedy remains protective;

- Require a soil management plan to address handling of soil with visible tailings that may be excavated in the future;

- Prevent the potential future use of groundwater that exceeds human health risk-based criteria as a drinking water source, i.e., within WMAs;

- Provide for permanent access to privately owned land to monitor and maintain the remedy; and

- Implement possible administrative access restrictions to some portions of the Site.

The estimated total cost for implementing Alternative 11M is $120 million (net present worth, based on a discount rate of 7 percent and a period of 50 years). This includes the estimated capital cost of $88.5 million, and estimated operations, maintenance, and monitoring (OMM) costs that average about $640,000 per year.

The duration for construction of Alternative 11M is anticipated to be 3 years, as discussed in the SFS. Alternative 11M would achieve RAOs shortly after the end of construction (e.g., based on containment and capping hazardous substances, institutional controls, and natural attenuation of the groundwater plume downgradient of the groundwater containment barriers following elimination of the sources of groundwater contamination). Alternative 11M would require continued operation and maintenance of the water treatment system for groundwater within the WMAs for hundreds of years.

Alternative 11M would achieve all ARARs, in particular the remedy selection and cleanup standards defined in MTCA, the water quality criteria defined under the Clean Water Act (CWA), the Forest Plan, and Washington's Limited Purpose Landfill regulations; see Table 16 for a detailed breakdown.

The main remedial components of Alternative 11M are summarized below by media or AOI.

Soil and Sediment

The side slopes of Tailings Piles 1, 2, and 3 would be stabilized and the lower portions near Railroad Creek moved back to reduce erosion and releases of tailings into the creek. The Copper Creek Diversion and the Copper Creek channel would be modified to prevent future erosion and releases of tailings into surface water. After regrading, the tailings piles and the East and West Waste Rock Piles would be capped. Before capping, contaminated soil excavated from the Honeymoon Heights Waste Rock Piles and the impacted DSHH area would be consolidated with the tailings piles. Sediment in Railroad Creek would be remediated by excavating ferricrete from the creek bed.

Soil in the Lower West Area, the Wind-Blown Tailings Area, and in Holden Village would be remediated by both excavation and consolidation of soil with hazardous substances, and by *in situ* treatment. The combination of the excavation and consolidation and *in situ* treatment methods will be based on the degree of contamination, the function of the habitat, and the succession stage of the habitat to be remediated.

Soil exceeding cleanup criteria in the Maintenance Yard would be left in place and capped. Soil at the Lagoon Area and Surface Water Retention Area would be excavated and consolidated with the tailings prior to capping. An investigation would be accomplished during remediation design activities to determine the extent of waste rock contamination (if any) of the Lucerne-Holden Road. The results of the investigation would be used to develop a cleanup approach, if necessary.

Groundwater

A fully penetrating (i.e., keyed into a lower, relatively impermeable layer of glacial till or bedrock) groundwater containment barrier would be constructed along the downgradient side of the tailings piles and the Lower West Area to prevent ARD from discharging into Railroad Creek. The barrier and treatment system would hydraulically control and collect contaminated groundwater and seeps and protect surface water in Railroad Creek from the release of the groundwater and seeps that exceed aquatic protection standards.

Concentrations of hazardous substances in the Main Portal discharge would be reduced by reducing airflow through the mine, thus reducing the rate of oxidation of sulfide minerals within the mine. Groundwater discharging from the mine (AMD) would be collected and treated.

Surface Water

Surface water run-on would be controlled by constructing stormwater diversion swales and other measures upgradient from Tailings Piles 1, 2, and 3 and the East and West Waste Rock Piles. The diversion swales will reduce the run-on from upslope that could otherwise infiltrate into the tailings and waste rock piles and become contaminated. This will reduce the amount of contaminated groundwater that must be contained by the groundwater barrier walls that, along with flow from the mine and seeps downgradient of Honeymoon Heights, must be collected and conveyed to the treatment system. These actions would limit discharge of contaminants in groundwater above ARARs into Railroad Creek.

Former Mill Building

The Mill Building superstructure would be demolished. Soil exceeding cleanup levels at the former Mill Building would be excavated and consolidated with the tailings piles prior to capping or disposed of off site, depending on results of waste designation during remediation.

9.1.2 Alternative 12 (No-Action Alternative)

Estimated Total Project Cost per the ASFS: $0

CERCLA requires a "no-action alternative" to be developed and considered in the analysis of the developed alternatives. The no-action alternative would leave the Site untouched and would not include institutional controls or long-term monitoring. Ongoing releases of hazardous substances would continue under this alternative. Existing risks caused by hazardous substances in soil, groundwater, and surface water would not be addressed except by source depletion and possibly natural attenuation that would occur gradually over a period of hundreds of years.

Alternative 12 includes no actions to control exposure of ecological receptors to contaminants. Risks to fish and other aquatic receptors, and terrestrial receptors would continue for the foreseeable future.

9.1.3 Alternative 13M (Soil and Source Area Consolidation and Capping; Limited Groundwater Collection and Treatment; Isolation of Ferricrete by Stream Relocation, and Institutional Controls)

Estimated Capital Cost: $56,400,000

Estimated Average Annual O&M Costs: $470,000

Estimated Present Worth Costs: $79,800,000

Estimated Construction Timeframe: Two to three years (not including anticipated preliminary work).

Estimated Time to Achieve RAOs: Alternative 13M would protect human health but would not sufficiently protect terrestrial or aquatic organisms.

Alternative 13M includes: consolidation and capping the tailings piles, waste rock piles, and impacted soil; and containment and collection for treatment of impacted groundwater from a WMA that consists of the Lower West Area, main East and West Waste Rock Piles, and Tailings Pile 1 (but would not include containment and collection of impacted groundwater from Tailings Piles 2 and 3). Alternative 13M also includes relocation of Railroad Creek, which would eliminate the effects of ferricrete on aquatic habitat, and implementation of institutional controls. Alternative 13M relies on the following treatment technology: pH adjustment and precipitation for removal of metals from ARD.

Alternative 13M would require institutional controls, including a restrictive covenant on private property (e.g., the patented mining claims owned by Holden Village) and the notation of restrictions in the Forest Service Land Status Records for the Okanogan-Wenatchee National Forest. These institutional controls would be required for hundreds of years to:

- Notify the public of contaminated areas that will be left on the Site, and prevent humans from direct contact with hazardous substances by warning of the risk;
- Protect the integrity of the remedy by preventing changes in Site use that would reduce effectiveness of the remedy;

- Include a requirement for consultation with the Agencies prior to changes in land use to ensure that the remedy remains protective;
- Require a soil management plan to address handling of soil with visible tailings that may be excavated in the future;
- Prevent the potential future use of groundwater that exceeds human health risk-based criteria as a drinking water source, i.e., within WMAs;
- Provide for permanent access to privately owned land to monitor and maintain the remedy; and
- Implement possible administrative access restrictions to some portions of the Site.

The estimated total cost for implementing Alternative 13M is $79.8 million (net present worth, based on a discount rate of 7 percent and a period of 50 years). This includes the estimated capital cost of $56.4 million, and estimated OMM costs that average about $470,000 per year.

The duration for construction of Alternative 13M is anticipated to be 2 to 3 years, as discussed in the ASFS. Alternative 13M would not achieve RAOs after the end of construction (e.g., it would not fully address the sources of contamination to groundwater, or the effects of hazardous substances on terrestrial receptors in some areas of the Site). Alternative 13M would require continued operation and maintenance of the water treatment system for groundwater within the WMA for hundreds of years. Alternative 13M would allow the continued release of groundwater above cleanup levels, from below Tailings Piles 2 and 3, for hundreds of years.

Alternative 13M would protect human health through containment and capping of hazardous substances, and institutional controls. Alternative 13M would not achieve all ARARs; specifically the remedy selection and cleanup standards defined in MTCA, the water quality criteria defined under the CWA, the Forest Plan, and Washington's Limited Purpose Landfill regulations, see Table 16 for a detailed breakdown.

The main remedial components of Alternative 13M are summarized below by media or AOI.

Soil and Sediment

Portions of the side slopes of Tailings Piles 1, 2, and 3 would be regraded to improve stability, and a portion of Railroad Creek would be relocated northward away from the tailings piles into a new channel. The relocation would isolate ferricrete from aquatic life in this reach of the channel. Relocating Railroad Creek would also enable construction of a groundwater barrier adjacent to a portion of the tailings piles without the need to excavate the tailings to move the toe of the slope away from the creek. The former creek channel would be used to collect groundwater impacted by seepage from the western portion of Tailings Pile 2, and to convey groundwater to a water treatment facility located east of Tailings Pile 3. The Copper Creek channel would also be modified to reduce the risk of erosion and scour on Tailings Piles 1 and 2.

After regrading, the tailings piles and East and West Waste Rock Piles would be capped with soil and vegetated. Excess rock generated from regrading would be relocated onto Tailings Pile 1 and the former Mill Building foundation. Before capping, contaminated soil excavated from the Lagoon Area would be consolidated with the tailings piles. Soil exceeding cleanup criteria in the Maintenance Yard would be left in place and capped with concrete or a gravel cap with an impermeable liner.

No remediation would be done to address contaminated soil from the Honeymoon Heights Waste Rock Piles and the impacted DSHH area, the Ballfield, the Lower West Area, or in Holden Village.

Groundwater

A fully penetrating (i.e., keyed into a lower relatively impermeable layer of glacial till or bedrock) groundwater containment barrier would be constructed along the downgradient side of Tailings Pile 1 and the Lower West Area to prevent ARD from part of the Site from discharging into Railroad Creek. Groundwater flowing from seeps downslope of Honeymoon Heights would also be collected. However, ARD from Tailings Piles 2 and 3 would not be contained or collected for treatment under Alternative 13M.

Hydraulic bulkheads would be installed in the mine to control and equalize the rate of groundwater discharging from the Main Portal. Concentrations of hazardous substances in the Main Portal discharge would be reduced by installing air restrictors in open portals to reduce air flow through the mine, thus reducing the rate of oxidation of sulfide minerals within the mine.

Groundwater discharging from the mine (AMD), the collected seeps, the Lower West Area, and Tailings Pile 1 groundwater containment area would be conveyed to treatment facilities located in the Lower West Area and east of Tailings Pile 3.

Surface Water

Surface water run-on would be controlled by constructing stormwater diversion swales and other measures upgradient from Tailings Piles 1, 2, and 3 and the East and West Waste Rock Piles.

Surface water impacts to Railroad Creek from groundwater are addressed in this alternative by: 1) relocating a portion of Railroad Creek to isolate ferricrete from the aquatic habitat; 2) using the former creek channel (before relocation) as a collection trench to collect and convey groundwater for treatment; and 3) using a hydraulic barrier placed around Tailings Pile 1 and the Lower West Area to stop discharge of contaminated groundwater (including seeps and discharge from the Main Portal). Erosion of the tailings into Railroad Creek would be prevented through regrading and capping to prevent future surface water impacts from physical transport of the tailings.

Former Mill Building

The Mill Building superstructure would be demolished; contaminated materials remaining within the Mill Building would be covered with waste rock, covered with soil cover, and re-vegetated.

9.1.4 Alternative 14 (Soil and Source Area Consolidation and Capping; Groundwater Collection and Treatment; Isolation of Ferricrete by Stream Relocation, *In Situ* Treatment, and Institutional Controls)

Estimated Capital Cost: $76,100,000

Estimated Average Annual O&M Costs: $615,000

Estimated Present Worth Costs: $107,000,000

Estimated Construction Timeframe: Two years preliminary work plus a total of 4 years of heavy construction (in two phases).

Estimated Time to Achieve RAOs: Alternative 14 would protect human health and is anticipated to be protective of the environment shortly after the remedy is implemented.

Alternative 14 includes: consolidation and capping the tailings piles, waste rock piles, and impacted soil; containment and collection for treatment of impacted groundwater from within designated WMAs; relocation of Railroad Creek to eliminate the effects of ferricrete on the aquatic environment; *in situ* treatment of some areas of impacted soil; and implementation of institutional controls. Alternative 14 relies on the following treatment technologies: pH adjustment and precipitation for removal of metals from ARD; and pH adjustment to decrease the mobility and toxicity of some areas of impacted soils.

Alternative 14 would require institutional controls including a restrictive covenant on private property (e.g., the patented mining claims owned by Holden Village) and the notation of restrictions in the Forest Service Land Status Records for the Okanogan-Wenatchee National Forest. These institutional controls would be required for hundreds of years to:

- Notify the public of contaminated areas that will be left on the Site, and prevent humans from direct contact with hazardous substances by warning of the risk;
- Protect the integrity of the remedy by preventing changes in Site use that would reduce effectiveness of the remedy;
- Include a requirement for consultation with the Agencies prior to changes in land use to ensure that the remedy remains protective;
- Require a soil management plan to address handling of soil with visible tailings that may be excavated in the future;
- Prevent the potential future use of groundwater that exceeds human health risk-based criteria as a drinking water source, i.e., within WMAs;
- Provide for permanent access to privately owned land to monitor and maintain the remedy; and
- Implement possible administrative access restrictions to some portions of the Site.

The institutional controls would include signage to warn of human health risks in areas subject to long-term *in situ* treatment, such as portions of the Lower West Area, Honeymoon Heights Waste Rock Piles, and the impacted areas downslope of Honeymoon Heights Waste Rock Piles (DSHH).

The estimated total cost for implementing Alternative 14 is $107 million (net present worth, based on a discount rate of 7 percent and a period of 50 years). This includes the estimated capital cost of $76.1 million, and estimated OMM costs that average about $615,000 per year.

The duration for construction of Alternative 14 is anticipated to be about 6 years, including 2 years of early work, 2 years of heavy construction for Phase 1, and 2 years of heavy construction for Phase 2, as discussed in Section 4.1.[18] Alternative 14 would achieve RAOs shortly after the end of construction (e.g., based on containment and capping hazardous substances, institutional controls, and natural attenuation of the groundwater plume at and downgradient of the groundwater containment barriers following elimination of the sources of groundwater contamination). Although groundwater will continue to exceed cleanup levels downgradient of Tailings Piles 2 and 3 until shortly after the end of the second phase of construction, the first phase of the remedy will eliminate risks to human health and most terrestrial receptors (except in the wetland downgradient of Tailings Pile 3. Alternative 14 would require continued operation and maintenance of the water treatment system for groundwater within the WMAs for hundreds of years.

Alternative 14 would achieve all ARARs, in particular the remedy selection and cleanup standards defined in MTCA, the water quality criteria defined under the CWA, the Forest Plan, and Washington's Limited Purpose Landfill regulations (see Table 16 for a detailed breakdown).

---

[18] Construction schedules were not evaluated to the same level of detail for all alternatives considered in the final Feasibility Study. In particular, Alternatives 11M and 13M were developed without discussion of the concept of early work (e.g., road improvements, quarry and borrow source development, preparation of construction staging areas, and relocation of some of Holden Village's infrastructure) that were developed to reduce the duration of heavy construction. Alternative 14 and the Selected Remedy were planned to be completed in two stages of heavy construction separated by a period of 5 years, to reduce the impacts of construction on Holden Village.

The main remedial components of Alternative 14 are summarized below by media or AOI. Alternative 14 (referred to as the Preferred Alternative in the Proposed Plan) is the basis for the Selected Remedy.

Soil and Sediment

A portion of the Railroad Creek stream channel would be relocated northward into a new channel to enable construction of a groundwater barrier around the tailings piles, and to reduce the risk of scour causing instability of the tailings piles. The Copper Creek stream channel would be modified to reduce the risk of erosion and scour, and the toe of Tailings Piles 1 and 2 would be pulled back away from Copper Creek.

Relocation of Railroad Creek and construction of the groundwater barrier walls would eliminate the effects of ferricrete on aquatic habitat. The new channel would bypass the reach where ferricrete has been deposited. Groundwater, with dissolved contaminants (primarily ferric oxides and sulfates) that form ferricrete, would be prevented from discharging into the new creek channel.

The tailings piles and East and West Waste Rock Piles would be regraded so they are stable, capped, and vegetated. Excess waste rock generated from regrading would be consolidated onto the tailings piles. The tailings piles, main East and West Waste Rock Piles, and the Lower West Area would be designated as WMAs.

Soil exceeding cleanup levels in several areas of the Site would be excavated and consolidated into the tailings piles before capping. These areas include:

- Soil above cleanup levels from the Ventilator Portal Surface Water Retention Area, the Ballfield, and existing disturbed portions of the Lower West Area including the Lagoon Area (other portions of the Lower West Area would be treated *in situ*, to avoid extensive disturbance of high-quality riparian habitat.

- Soil above cleanup levels in other areas where excavations are needed for other components of the remedy, such as relocating Railroad Creek in the Wind-Blown Tailings Area or for excavation of settling ponds for the groundwater treatment facility.

Soil exceeding cleanup criteria in the Maintenance Yard would be left in place and capped. Soil exceeding cleanup levels in other AOIs would be remediated using *in situ* treatment to reduce the mobility and bioavailability of hazardous substances where more active measures (i.e., consolidation and capping) is impracticable because of steep slopes, or would cause more adverse impacts than benefits. Examples of areas appropriate for *in situ* treatment include Holden Village and high-value, late successional habitat in portions of the Lower West Area, as noted above.

Finally, an investigation would be accomplished during remedial design to determine the extent of waste rock contamination (if any) of the Lucerne-Holden Road. The results of the investigation would be used to develop a cleanup approach if necessary.

Groundwater

A fully penetrating groundwater barrier wall would be constructed on the north, east, and west sides of the Lower West Area and Tailings Pile 1 to contain groundwater impacted by ARD. Groundwater contained in this area would be collected and conveyed to the treatment facility. Groundwater exceeding cleanup levels would also be collected from seeps downgradient of Honeymoon Heights. A second groundwater barrier, collection, and conveyance facility would be constructed on the north, east, and west sides of Tailings Piles 2 and 3 during the second phase of remedial construction to address ARD from this area. Intercepted groundwater would be conveyed through a combination of pipelines and open ditches to be treated before it is discharged into Railroad Creek (Figure 18). The water would be conveyed primarily by gravity flow, but depending on the final location of the treatment facility, pumping may also be required for at least some of the intercepted groundwater. The final alignment of the barrier wall and the southerly extent (e.g., between Tailings Piles 1 and 2, and on the east side of Tailings Pile 3) would be determined during remedial design, as discussed in the ASFS.

Hydraulic bulkheads would be installed in the mine to control the rate of groundwater discharging from the Main Portal. Concentrations of hazardous substances in the Main Portal discharge would be reduced by installing air restrictors in open portals to reduce airflow through the mine, thus reducing the rate of oxidation of sulfide minerals within the mine. The Main Portal discharge would be conveyed by pipeline to the groundwater treatment system, to prevent AMD discharge to Railroad Creek.

Three alternative locations for the treatment facility were evaluated in the FS. As discussed in the ASFS, final location and configuration of the treatment facility will be determined during remedial design considering both performance requirements and environmental tradeoffs. The location evaluated for Alternative 11M (north of Railroad Creek and east of Tailings Pile 3) has the advantage that it could be constructed without destruction of the wetland east of the tailings piles, but would require pumping the most groundwater for treatment. The location east of Tailings Pile 3 that was evaluated as part of Alternatives 13M and 14 would not require groundwater to be pumped, but would destroy the wetland. Finally, the location in the Lower West Area that was considered as part of Alternatives 13M and 14 would occupy a portion of the Railroad Creek floodplain that might otherwise be restored as riparian habitat following cleanup of the Lagoon Area and the Lower West Area.

These three alternatives include treatment of the collected groundwater by acid neutralization and precipitation, which will produce a by-product sludge that must be disposed of. Under Alternatives 11M and 14, the water treatment system sludge would be disposed of in a lined on-site landfill designed and constructed for this purpose. The potential use of an unlined sludge disposal facility, possibly on Tailings Pile 1 (i.e., within a groundwater containment area) could be further evaluated during remedial design, as proposed by Intalco for Alternative 13M.

Surface Water

Stormwater diversion swales would be constructed upgradient from Tailings Piles 1, 2, and 3 and the East and West Waste Rock Piles to control surface water run-on.

Surface water impacts to Railroad Creek from groundwater are addressed in this alternative by:

1) Relocating a portion of Railroad Creek as described above;

2) Installing groundwater barriers on the north, east, and west sides the Lower West Area and Tailings Pile 1, and the north, east, and west sides of Tailings Piles 2 and 3 to stop the discharge of contaminated groundwater as base flow into the creek;

3) Collecting and treating groundwater seeps and discharge from the mine; and

4) Preventing instability of the tailings piles that could cause the physical transport of tailings into the creeks.

The new creek channel will be lined where needed to prevent infiltration of clean water from the creek into the groundwater collection system, to minimize the volume of water that needs to be treated.

Former Mill Building

Unsafe structural components would be demolished as needed to investigate and, as needed, remove contaminated soil and ore processing residuals. Soil exceeding cleanup levels at the former Mill Building would be capped in place or excavated and consolidated with the tailings piles prior to capping, or disposed of off site, depending on results of waste designation during remedial design or implementation of the remedy.

9.1.5 Remedy Components Common to Alternatives 11M, 13M, and 14

Alternatives 11M, 13M, and 14 have a number of remedy components that are the same or likely to be so similar that they would not significantly change the comparison of the three alternatives. These remedy components are discussed in more detail in the ASFS and the Proposed Plan.

Some remedy components, while the same or very similar between the alternatives, warrant discussion. These components address work that limits future human exposure to hazardous substances at the Site, support construction work on remedy implementation, and monitor long-term effectiveness of the remedy. These components include institutional controls, remedy support infrastructure, and monitoring.

Institutional Controls

Administrative measures would be implemented to help protect the effectiveness of the remedy from changes in land use and reduce human exposure to remaining Site risks. These institutional controls would be required for hundreds of years.[19]

---

[19] Oxidation of sulfide minerals in the tailings and waste rock would gradually reduce the release of hazardous substances through source depletion. Appendix E of the DFFS provided an estimate for the duration that the tailings piles would continue to release hazardous substances to groundwater “for at least several decades” after the cessation

Institutional controls would be applied to all areas of the Site where hazardous substances are left in place, and, if not controlled, would present a risk to human health and the environment. These areas include the tailings and waste rock piles, Honeymoon Heights, the Lower West Area, Holden Village, the Wind-Blown Tailings Area, and possibly other areas such as the Ballfield Area depending on decisions that are made during remedial design or implementation of the remedy. These institutional controls would:

- Notify the public of contaminated areas that will be left on the Site, and prevent humans from direct contact with hazardous substances by warning of the risk;
- Protect the integrity of the remedy by preventing changes in Site use that would reduce effectiveness of the remedy;
- Include a requirement for consultation with the Agencies prior to changes in land use to ensure that the remedy remains protective;
- Require a soil management plan to address handling of soil with visible tailings that may be excavated in the future;
- Prevent the potential future use of groundwater that exceeds human health risk-based criteria as a drinking water source, i.e., within WMAs;
- Provide for permanent access to privately-owned land in order to monitor and maintain the remedy; and
- Implement possible administrative access restrictions to some portions of the Site.

The Forest Service would be responsible for implementing, monitoring, and enforcing the institutional controls on National Forest System lands, through the

---

of iron (and other metals) being generated by oxidation of sulfide minerals, but did not provide any estimate of when this ongoing chemical reaction might end. The DFFS analysis predicted that concentrations of metals in the mine drainage may decrease on the order of 50 percent over the next 60 years, but these concentrations would still significantly exceed cleanup levels and the mine would remain a source of ARD for an unknown period that may also be on the order of hundreds of years.

notation of restrictions in the Forest Service Land Status Records for the Okanogan-Wenatchee National Forest. Institutional controls will be implemented on private property owned by Holden Village (the patented mining claims) through a restrictive covenant.

Remedy Support Infrastructure

Remedy support infrastructure would include quarry site(s), borrow pit(s), reconstruction of the Lucerne barge landing facility, construction of a work camp and/or related infrastructure improvements at Holden Village, improvements to the Lucerne-Holden Road and bridges, electric power infrastructure, and other infrastructure, as needed. Development of hydroelectric power generating capacity as part of the remedy is highly desirable.

Long-Term Monitoring

Implementation of the remedy includes long-term monitoring to assess remedy performance, ARAR compliance, and protectiveness. Monitoring would be accomplished in accordance with a plan approved by the Agencies. Additional monitoring would also be required to determine whether additional remedial action is warranted, as summarized below:

- Monitoring seep SP-26, as well as groundwater downslope of Honeymoon Heights, to determine whether additional groundwater should be collected for treatment following implementation of source controls.

- Long-term sediment monitoring in Railroad Creek and in Lake Chelan at the Lucerne Bar to confirm that risks are low and decrease over time following implementation of source controls.

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section discusses the Agencies' evaluation of Alternatives 11M, 12, 13M, and 14 under CERCLA and MTCA.

10.1 Evaluation of Alternatives under CERCLA

Under CERCLA, the following criteria are used to evaluate remedial alternatives:

Threshold Criteria

1) Overall protection of human health and the environment.

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

2) Compliance with ARARs.

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), and the NCP at 40 C.F.R. § 300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations which are collectively referred to as ARARs, unless such ARARs are waived under CERCLA Section 121(d)(4).

Primary Balancing Criteria

1) Long-term effectiveness and permanence.

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on the Site following remediation and the adequacy and reliability of controls.

2) Reduction of toxicity, mobility, and volume through treatment.

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of treatment technologies that may be included in the remedy.

3) Short-term effectiveness.

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

4) Implementability.

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

5) Cost.

Cost of each alternative includes the capital cost and the net present worth of long-term costs to operate, maintain, and monitor the remedy.

Modifying Criteria

1) State acceptance of the alternatives.

This criterion considers acceptability of the alternative to the state where the site is located including the degree to which the alternative satisfies state requirements.

2) Community acceptance of the alternatives.

This criterion considers the degree to which the alternative is acceptable to the public, based on comments received on the Proposed Plan.

The threshold criteria are requirements that an alternative must meet to be eligible for selection. The primary balancing criteria form the basis for evaluation of alternatives that satisfy the threshold requirements. The modifying criteria are evaluated in the ROD following receipt of state and public comments on the RI/FS and the Proposed Plan.

10.1.1 Threshold Criteria

The threshold criteria are: 1) overall protection of human health and the environment; and 2) compliance with ARARs.

Overall Protection of Human Health and the Environment

Alternatives 11M, 13M, and 14 would each protect human health.

- Under Alternative 14, risks to humans from soil (including the tailings and waste rock in Tailings Piles 1, 2, and 3, and the East and West Waste Rock Piles), at the former Mill Building, Lagoon Area, Maintenance Yard, a portion of the Lower West Area, and the Ventilator Portal Surface Water Retention Area would be addressed by capping the material in place or moving the material and then capping it to prevent exposure. Risks from soil materials in the remainder of the Lower West Area, Honeymoon Heights Waste Rock Piles, and DSHH would be addressed through institutional controls.

- Alternative 13M addresses human-health risk from impacted soil (including soil with hazardous substances that exceed human health-based criteria for protection of groundwater) through a combination of removal, capping, and institutional controls. However, in the Lower West Area, Honeymoon Heights Waste Rock Piles, and DSHH AOIs, where there is risk to humans from direct contact or ingestion of hazardous substances in soil, Alternative 13M would rely solely on institutional controls and would not include any active cleanup measures.

- Alternative 11M would protect human health in the same manner as Alternative 14, except that Alternative 11M would address exposure to waste rock at Honeymoon Heights and soil in the DSHH that exceed direct contact and ingestion-based cleanup levels by moving the waste rock and impacted soil to the tailings piles for capping, while Alternative 14 would rely on *in situ* treatment and institutional controls.

Potential future use of impacted groundwater and surface water for drinking would be restricted by institutional controls for these three alternatives, and by containing water above drinking water standards in designated WMAs under Alternatives 11M and 14. In addition, safety to residents and visitors would be addressed through mine access restrictions.

Under Alternative 14, risks to terrestrial organisms from Tailings Piles 1, 2, and 3, the East and West Waste Rock Piles, former Mill Building, Lagoon Area, Maintenance Yard, a portion of the Lower West Area, and the Ventilator Portal Surface Water Retention Area would be addressed by excavation (consolidation) or capping hazardous substance containing materials in place to prevent exposure. Risks to terrestrial receptors in other areas (e.g., the remainder of the Lower West Area, Wind-Blown Tailings Area (except excavation incidental to other parts of the remedy), the remainder of the Ballfield Area, and in Holden Village) would be addressed by *in situ* treatment.

To protect aquatic organisms, contaminants from groundwater (including base flow, seeps, and the mine drainage) would be intercepted and treated before it discharges to surface water. The potential release of hazardous substances into Railroad and Copper Creeks from failure of the tailings pile slopes would be addressed by regrading, buttressing, and capping, and by stabilizing the existing and relocated reaches of Railroad Creek. Risks to aquatic organisms from ferricrete would be addressed by rerouting Railroad Creek. The toe of the tailings piles adjacent to Copper Creek (and possibly some areas along Railroad Creek, depending on the extent of creek relocation) would be pulled back as needed to construct stable slopes and the groundwater containment and collection components. Relocation of the creek (or moving the toe of the tailings piles away from the creek) is also needed to protect the tailings piles from erosion and scour by Railroad and Copper Creeks. Sediment in Railroad Creek and Lake Chelan would be monitored to confirm that risks are low and decrease over time following implementation of source controls.

Alternative 11M would protect the terrestrial and aquatic environment in a manner similar to Alternative 14, with a few significant differences:

- Under Alternative 11M, protection of the Railroad and Copper Creeks from tailings piles instability would require pulling the toe of the tailings piles back along the slopes abutting the creeks; and

- Under Alternative 11M, exposure to waste rock at Honeymoon Heights and DSHH would be addressed by moving the material to the tailings piles and capping it rather than through *in situ* treatment.

Alternative 11M would protect the aquatic environment in a manner similar to Alternative 14. Both these alternatives include regrading to stabilize the tailings pile slopes adjacent to the creek and capping, as well as a groundwater barrier and collection system between the tailings piles and the creeks.

Alternatives 11M and 14 differ in the location of the proposed treatment facility needed to protect surface water. Alternative 11M would enable the wetland east of Tailings Pile 3 to be remediated, whereas, under Alternative 14 the wetland would become the location of the treatment facility.

There are significant differences in the way in which Alternative 13M would address the environment compared to Alternatives 14 and 11M. Because of these differences, (which are more fully discussed in Sections 6.2.2 and 6.3.2 of the ASFS), Alternative 13M would not fully protect the environment.

- Under Alternative 13M, the risk to terrestrial receptors from materials in the Lower West Area, Honeymoon Heights Waste Rock Piles, DSHH, and Holden Village would not be addressed, except by monitoring.

- Alternative 13M would intercept and treat impacted groundwater from some parts of the Site before it enters surface water, and includes the former Railroad Creek channel as the collection system along the northwest side of Tailings Pile 2, but it does not include a barrier wall or other active remedial measures downgradient of Tailings Piles 2 and 3. Groundwater impacted by releases from Tailings Piles 2 and 3 exceeds aquatic life protection criteria and contributes to the extensive adverse impacts to surface water quality and aquatic life adjacent to and downgradient of the tailings piles. There is no evidence that Alternative 13M would meet proposed surface water cleanup levels in groundwater before surface water enters Railroad Creek downstream from Tailings Piles 2 and 3.

Similar to Alternative 14, Alternative 13M would involve construction of a groundwater treatment facility within the wetland east of Tailings Pile 3.

Alternative 12, the No Action Alternative, would not protect human health or the environment, since it would not address risks from the ongoing release and presence of hazardous substances at the Site.

Compliance with ARARs

The other threshold criterion under CERCLA is compliance with ARARs [42 U.S.C. § 9621(d)(2); 40 C.F.R. § 300.430(e)(9)(iii)(B) & (f)(1)(i)(A)]. In this section, the alternatives are assessed to determine ARARs attainment under federal environmental laws and state environmental or facility siting laws, or whether there are grounds for invoking one of the waivers listed in 42 U.S.C. § 9621(d)(4); 40 C.F.R. § 300.430(f)(1)(ii)(C).

The ability of the alternatives to meet chemical-specific ARARs at the points of compliance (POCs) for surface water, groundwater, and soil, and to meet action-specific ARARs are compared below and in Tables 16 (chemical-specific ARARs) and 17 (action-specific ARARs). Tables 18 and 19 also summarize the location-specific ARARs and TBCs that would be satisfied by these alternatives. See Table 20 for a description of POCs.

Chemical-Specific Requirements for Surface Water

Under Alternatives 11M and 14, implementation of cleanup actions is expected to satisfy chemical-specific ARARs for surface water based on protection of aquatic life in Railroad Creek and the Copper Creek Diversion.

Alternatives 11M and 14 both address all identified, existing sources of hazardous substance releases into surface waters through containment, collection, and treatment. Thus, these alternatives are expected to satisfy potential chemical-specific ARARs for surface water including the National Recommended Water Quality Criteria (NWQC), National Toxics Rule, Maximum Contaminant Levels (MCLs), Washington State Drinking Water Standards, Washington State Water Quality Standards for Surface Water, and MTCA.

Alternative 11M includes design and operation of the treatment plant to meet discharge limits, which could include a mixing zone, if approved. Alternative 14 includes design and operation of two groundwater treatment plants that may be operated in series or independently, to treat flows from different portions of the Site to meet discharge limits, which could include a mixing zone, if approved.

It is unlikely that Alternative 13M would satisfy chemical-specific ARARs for surface water, such as the NWQC, Washington State Water Quality Standards for Surface Water, and MTCA. Alternative 13M addresses many—but not all—identified, existing sources of hazardous substance releases into surface waters through containment, collection, and treatment. Under Alternative 13M, uncontrolled discharge of groundwater, containing hazardous substances in concentrations greater than water quality criteria, would continue into surface water from Tailings Piles 2 and 3. There is no evidence that the other actions contemplated in Alternative 13 will reduce those concentrations to levels that meet water quality standards. The uncontrolled discharge creates considerable uncertainty as to whether Alternative 13 can meet surface water cleanup levels based on protection of aquatic life in Railroad Creek downstream from Tailings Piles 2 and 3.

Drinking water ARARs for surface water would be met for these three alternatives.

Chemical-Specific Requirements for Groundwater

Under Alternatives 11M and 14, the groundwater barrier walls will provide containment so that the areas within the walls qualify for designation as a WMA.

Without these WMAs, MCLs would need to be met throughout the Site. Under Alternatives 11M and 14, groundwater exceeding MCLs would be contained within WMAs. Following implementation, Alternatives 11M and 14 are both expected to meet chemical-specific ARARs for groundwater in areas at and beyond the edge of the WMAs.

Intalco's description of Alternative 13M did not include containment and, therefore, would not include designation of establishing any WMAs. It is unlikely that Alternative 13M would meet MCLs in groundwater under and downgradient of Tailings Piles 2 and 3. Because of this lack of containment, Alternative 13M also cannot satisfy the requirements for establishing a conditional point of compliance under WAC 173-340-720(8)(c) & (d) as related to achieving groundwater cleanup levels for surface water protection. These requirements include that a conditional POC "be as close as practicable to the source of hazardous substances" provided that all practicable methods of treatment are used in the Site cleanup [WAC 173-340-720(8)(c)], and that before a conditional POC may be established at the point(s) where groundwater enters surface water, AKART must be applied, among other conditions [WAC 173-340-720(8)(d)(i)]. Under CERCLA, cleanup levels based on protection of surface water must similarly be met before groundwater enters Railroad Creek downgradient of Tailings Piles 2 and 3.

Chemical-Specific Requirements for Soil

Under Alternatives 14 and 11M, soil exceeding cleanup levels would be addressed through a combination of removal, containment, *in situ* soil treatment, and monitoring. Alternatives 11M and 14 are both expected to meet chemical-specific ARARs for soil established under MTCA.

Except for monitoring, Alternative 13M does not address soil contamination in the following areas: Honeymoon Heights Waste Rock Piles, the DSHH, Lower West Area (outside the Lagoon Area), or Holden Village. Alternative 13M assumes that remediation would occur naturally over time. As a result, Alternative 13M would not satisfy chemical-specific ARARs for soil.

Action- and Location-Specific Requirements

The Agencies anticipate that Alternatives 11M and 14 would satisfy potential action-specific ARARs. It is not clear whether Alternative 13M satisfies all action-specific ARARs. Additional information would need to be developed during remedial design/remedial action to determine whether Alternative 13M would satisfy potential action-specific ARARs, including:

- Intalco has not presented information that shows that the 6-inch soil/gravel and wood slash cover proposed for the tailings and waste rock piles (or the 12-inch cover discussed in URS 2010a) would satisfy the performance requirements for closure of limited purpose landfills [WAC 173-350-400(3)(e)(i)] which is the primary ARAR for capping the tailings and waste rock piles at the Site.

- Intalco has not presented information to support its proposal to construct unlined ponds as part of the groundwater treatment system. Use of unlined ponds would not satisfy ARARs including Chapter 90.48 RCW, Chapter 90.54 RCW, WAC 173-240-130(2)(t), and WAC 173-201A because the lining is required to prevent seepage from the ponds that would violate state water quality standards.

Mitigation to address adverse impacts of the cleanup action, e.g., destruction of habitat to construct remedy components, disturbance of habitat (especially for threatened and endangered species) during construction; visual quality; air quality; etc., would be implemented as required by the Forest Plan.[20] If mitigation would not satisfactorily address Forest Plan requirements, the Forest Service may amend the Forest Plan or portions of this ARAR could be waived under CERCLA, if appropriate.

Monitoring during and after implementation would be used for these three alternatives, to assess compliance, as required under both CERCLA and MTCA action- and location-specific ARARs.

Washington's Sediment Management Standards are relevant and appropriate, including provisions that prohibit activities that would degrade existing beneficial uses [WAC 173-204-120], and specify procedures for managing sources of

[20] The Forest Plan refers to the Land and Resource Management Plan for Wenatchee National Forest (LRMP, Forest Service 1990), as amended by Pacific Northwest Forest Plan (NWFP, 1994) and subsequent amendments of the NWFP (2001, 2004, and 2007). The Forest Plan is required under the National Forest Management Act [16 U.S.C. §§ 1600 – 1614] (NFMA) which is the primary statute governing the administration of National Forests.

sediment contamination [WAC 173-204-400]. Under Alternatives 14 and 13M, the adverse effects of ferricrete on aquatic habitat in Railroad Creek would be eliminated by stream relocation. Ferricrete would be removed from Railroad Creek under Alternative 11M.

Remediation under Alternative 11M and 14 would include preventing the discharge of iron- and aluminum-rich groundwater from the tailings piles, which would prevent formation of floc that contains hazardous substances in Railroad Creek. Under both Alternative 11M and 14, sediment in Railroad Creek downstream from Tailings Pile 3 and sediment in Lake Chelan at the Lucerne Bar would be monitored to confirm that risks to benthic macroinvertebrates are low and decrease over time through natural deposition of clean sediment.

Under Alternative 13M, groundwater containing elevated concentrations of dissolved iron and aluminum would continue to flow into Railroad Creek from Tailings Piles 2 and 3. As a result, floc containing hazardous substances would continue to form in Railroad Creek and affect aquatic receptors.

10.1.2 Primary Balancing Criteria

According to the NCP, the selected alternative must provide the best balance of tradeoffs among alternatives (that satisfy the threshold criteria) in terms of the five primary balancing criteria [40 C.F.R. § 300.430(f)(1)(ii)(E)].

Under CERCLA, only alternatives that meet the CERCLA threshold criteria for selecting a final remedy are typically carried forward and compared using the primary balancing criteria. As mentioned in Section 9, Alternatives 1 through 10 that are summarized in Table 14, did not meet the threshold criteria and were not carried forward in the comparative analysis. Alternatives 14 and 11M meet the threshold criteria and, therefore, were carried forward. Although Alternative 13M does not meet the threshold criteria, it is also carried forward in the following discussion for completeness and to better compare and understand these three alternatives.

Long-Term Effectiveness and Permanence

Alternatives shall be assessed for their long-term effectiveness and permanence, along with the degree of certainty that the alternative will be successful [40 C.F.R. § 300.430(e)(9)(iii)(C)]. The two factors considered for long-term effectiveness and permanence are:

- Magnitude of residual risk remaining from the untreated waste or treatment residuals remaining at the conclusion of the remedial activities; and

- Adequacy and reliability of controls necessary to manage treatment residuals and untreated waste.

Magnitude of Residual Risk Remaining at the Conclusion of the Remedial Activities

Alternatives 11M and 14 would fully address human health and ecological risk associated with soil (including tailings and waste rock) in most areas of the Site, as well as all groundwater, surface water, and sediment. Pending the result of treatability studies during remedial design, there is some question of the time required for *in situ* treatment to achieve cleanup levels, and whether the *in situ* treatment proposed for Alternatives 11M and 14 would fully address risks to terrestrial receptors in Holden Village, portions of the Ballfield Area, and portions of the Lower West Area. Alternative 11M includes removal of waste rock and impacted soil from the Honeymoon Heights Waste Rock Piles and the DSHH Area, whereas Alternative 14 would use *in situ* treatment in these areas to avoid the adverse environmental impacts caused by construction of an access road and long-term erosion of steep slopes in this area. Site-specific studies during remedial design would determine the most effective methods of treatment and whether pH adjustment could, in fact, be accomplished without causing other more adverse impacts than the existing risks caused by hazardous substances.

Alternative 13M would also address human health-based risks associated with soil. Alternative 13M would rely on what Intalco refers to as “natural recovery” but does not include any active measures to address risks to terrestrial organisms in the Lower West Area, Honeymoon Heights, Holden Village, DSHH, and the Ballfield Area. Alternative 13M would not address potential risks to aquatic organisms associated with groundwater from Tailings Piles 2 and 3 discharging to Railroad Creek.

Alternative 13M would result in more residual risk at the conclusion of remedial activities compared to Alternatives 11M and 14.

Adequacy and Reliability of Controls

To assess the adequacy and reliability of controls at the Site, items to be addressed under CERCLA are: 1) uncertainties associated with land disposal of treatment system residuals; 2) potential need to replace technical components of the remedy; and 3) potential risk if components of the remedy need replacement [40 C.F.R. § 300.430(e)(9)(iii)(C)(2)]. These three items are discussed below.

Alternatives 11M, 13M, and 14 each include permanent disposal of water treatment system sludge in a monitored on-site landfill constructed for that purpose. Since the landfill would need to satisfy state requirements for location, design, construction, operation, closure, and monitoring of limited purpose landfills, it is unlikely that hazardous substances would be re-released to the environment from the landfill for any of these three alternatives.

Technical component replacement requirements under Alternatives 11M, 13M, and 14 would be similar, except that the membrane liner system used in the Alternative 11M tailings and waste rock pile caps would be more difficult to maintain and repair compared to Alternatives 13M and 14.

As discussed in the ASFS, there would be a similarly low risk to human health and the environment, compared with existing conditions, should remedy components fail or need to be replaced under Alternatives 11M, 13M, and 14.

Reduction of Toxicity, Mobility, or Volume through Treatment

The second criterion of the primary balancing criteria is assessing the degree to which alternatives employ treatment to reduce toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site [40 C.F.R. § 300.430(e)(9)(iii)(D)].

Under Alternatives 11M, 13M, and 14 hazardous substances would be immobilized in sludge contained in an on-site landfill following treatment of intercepted groundwater. Alternatives 11M and 14 would prevent migration of hazardous substances in groundwater from the known source areas. Alternative 13M would not prevent migration of hazardous substances in groundwater under Tailings Piles 2 and 3, and contaminated groundwater would continue to discharge to Railroad Creek.

Short-Term Effectiveness

Evaluation of short-term effectiveness under CERCLA includes the following items:

- Short-term risks that might be posed to the community during implementation of an alternative;
- Potential impacts on workers and the effectiveness and reliability of protective measures;
- Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigation measures during implementation; and
- Time until protection is achieved.

Short-term risks to the community would be primarily associated with construction traffic and would be similar under Alternatives 11M, 13M, and 14. The risk would be mitigated through implementation of a traffic control plan.

Potential impacts to workers during remedial construction would be similar for Alternatives 11M, 13M, and 14 and would generally include construction hazards: mine entry, traffic, exposure to site soil, excavation, demolition, and heavy equipment operation. These could be adequately mitigated under each alternative through adherence to applicable safety and health regulations (OSHA, L&I, MSHA, etc.) including worker training, monitoring, and protective measures.

Human health risks associated with remedy implementation also include handling fuel and caustic chemicals used in operating the groundwater treatment system. For these three alternatives, this risk can be mitigated through development and implementation of an appropriate accident prevention plan and worker training.

These three alternatives have some **potential adverse environmental impacts** that are not compliant with the Forest Plan. Mitigation to address adverse impacts such as permanent habitat destruction, temporary disturbance of habitat during construction, visual impacts, etc., would be implemented as required by the Forest Plan. In the event mitigation would not satisfactorily address requirements of the Forest Plan, the Forest Service may amend the Forest Plan or portions of this ARAR could be waived under CERCLA.

The relative effects of Alternatives 11M, 13M, and 14 are discussed in the ASFS and summarized below.

- Alternatives 11M, 13M and 14 each involve construction of hydraulic barriers in the underground mine and share a common risk that this will degrade water quality of the mine discharge. However, each of these alternatives includes collection and treatment of the mine discharge.

- Alternative 11M would almost immediately prevent the discharge of groundwater into surface water with concentrations above aquatic life protection levels. The time for groundwater between the barrier wall and Railroad Creek to achieve cleanup levels has not been determined, but is expected to be on the order of months or a few years at most, since the groundwater barrier wall would be located immediately adjacent to the creek. Alternative 14 would delay construction of the second phase groundwater barrier and collection system for 5 years, which would decrease its short-term effectiveness relative to Alternative 11M. In contrast, Alternative 13M would not contain groundwater impacted by releases from Tailings Piles 2 and 3, and the Agencies expect the adverse impacts to Railroad Creek would continue for tens if not hundreds of years.

- Alternatives 11M, 13M, and 14 would each mitigate future physical impacts to Railroad Creek by substantially reducing the risk of tailings pile instability. Alternatives 14 and 11M include pulling back portions of Tailings Piles 1 and 2 from Copper Creek and improvements to the Copper Creek channel. Alternative 13M would not sufficiently reduce the current risk that instability of Tailings Piles 1 and 2 could cause a release of tailings into Copper Creek.

- These three alternatives pose some risk of a bentonite/cement release to surface water during barrier wall construction, with the risk for Alternatives 11M and 14 greater than those for Alternative 13M. These three alternatives also involve the risk of spills of hazardous materials during construction vehicle fueling and maintenance, and from long-term operation of the treatment system.

- Alternative 14 includes *in situ* treatment to address the Honeymoon Heights Waste Rock Piles, the DSHH, a portion of the Ballfield Area, Holden Village, and a portion of the Lower West Area. Depending on the effectiveness of *in situ* treatment, this could increase the time required before cleanup levels are achieved in these areas, but with significantly less disturbance and loss of habitat compared to more intrusive measures contemplated by Alternative 11M. If *in situ* treatment is not effective, Ecology, under MTCA, could use its substantive authority under SEPA to not require other active measures with greater potential adverse impacts on the existing habitat. For the purposes of CERCLA, a waiver of the MTCA ARAR relating to cleanup standards may be appropriate based on 42 U.S.C. § 9621(d)(4)(B), which allows an ARAR to be waived where the harm to the environment is greater because of the implementation of the remedial action than from the contamination itself. Alternative 11M also includes *in situ* treatment for some AOIs, but not Honeymoon Heights. Alternative 11M would have a permanent, adverse impact (e.g., loss of topsoil, long-term erosion and sediment transport downslope, and slope instability) to habitat over an area of 78 acres or more following removal of waste rock and contaminated soil from Honeymoon Heights. These impacts include: 1) destruction of habitat associated with road construction and removal of the impacted soils and waste rock piles; and 2), long-term habitat damage associated with converting forested habitats to bedrock, and erosion, sedimentation, and mass wasting processes from disturbance of the steep-sloped Honeymoon Heights. Alternative 13M does not accomplish any cleanup to reduce risk to terrestrial receptors from soil in the Honeymoon Heights Waste Rock Piles, the DSHH, Lower West Area, Holden Village, and the Wind-Blown Tailings Area.

- Alternative 11M would have a greater risk of surface water quality exceedances associated with discharge from the groundwater treatment facility compared to Alternatives 13M and 14. Although these three alternatives would use similar pH adjustment and precipitation methods to remove hazardous substances during treatment, Alternative 11M relies on pumping, whereas Alternatives 13M and 14 are proposed to be gravity flow-through systems. Alternative 11M could produce surface water quality exceedances if there is a pump or generator failure during the life of the remedy. Alternative 11M could also have higher fuel consumption requirements and, hence, greater risk of a fuel spill compared to Alternatives 13M and 14.

- Alternatives 13M and 14 involve permanent destruction of the wetland habitat east of Tailings Pile 3 for construction of a groundwater treatment facility; whereas, the Alternative 11M treatment system would occupy a portion of the Wind-Blown Tailings Area that is forested. Wetland habitat in the Railroad Creek valley is much less common than forest habitat, so Alternatives 13M and 14 would have greater negative impacts compared to Alternative 11M, in this regard.

The three alternatives also differ in the **time required until protection is achieved**. Time to achieve cleanup levels through *in situ* treatment under Alternatives 11M and 14 will not be known until completion of treatability studies as part of implementing the remedy, but it is expected to take longer than in the areas where soil is removed and/or capped. Alternative 13M would not be fully protective of the environment since it does not include any active measures to protect terrestrial receptors in the Honeymoon Heights Waste Rock Piles, DSHH, Lower West Area, and Holden Village. Alternative 13M does not contain and treat releases of contaminated groundwater from Tailings Piles 2 and 3 and does not provide data which would indicate the time required until protection of aquatic receptors and surface water ARARs are achieved.

These three alternatives would protect human health at the time the remedy is implemented. However, the three alternatives each have both advantages and disadvantages with respect to short-term effectiveness in protecting the environment. On balance, considering the points listed above, the Agencies concluded that Alternative 14 has overall better short-term effectiveness compared to Alternatives 11M and 13M.

Implementability

Implementability is evaluated under CERCLA considering technical feasibility, administrative feasibility, and availability of services and materials. These three alternatives are considered to be implementable as discussed in the final Feasibility Study (see Section 6.4.2.4 of the ASFS).

Alternatives 14, 11M, and 13M are each technically feasible and could be implemented using conventional construction equipment and methods. Intalco has questioned feasibility of constructing groundwater containment barriers to depths of 100 feet or more (e.g., adjacent to Tailings Pile 3). However, the case history data summarized in Appendix C of the SFS showed this technology has been implemented to depths of more than 100 feet, including in soils with boulders as anticipated at Holden. The equipment, materials, and skilled workers needed are available for use at the Site.

These three alternatives are administratively feasible. The Agencies have reviewed the substantive requirements for similar actions and have determined that these can be met. The Agencies do not foresee any administrative barriers to implementation of Alternatives 14, 11M, or 13M.

Cost

Costs for these three alternatives in 2010 dollars (rounded to three significant figures) are summarized below.[21] Table 21, below, presents a comparison of the net present value of future costs for the alternatives.

Table 21 - Net Present Value of Alternatives

	Alternative 11M	Alternative 13M	Alternative 14
Estimated Capital Cost	$88,500,000	$56,400,000	$76,100,000
Net Present Value of Long-Term Operations, Maintenance, and Monitoring[22]	$31,800,000	$23,400,000	$30,700,000
Total Estimated Cost:	$120,000,000	$79,800,000	$107,000,000

Alternative 11M would cost more than Alternative 14, primarily because of the cost associated with using a geomembrane as part of the cap for tailings and waste rock piles, and the cost of removing the Honeymoon Heights Waste Rock Piles and impacted soil in the DSHH. Additional differences in cost are discussed in Appendix A of the ASFS.

---

[21] The Agencies prepared cost estimates for these three alternatives to provide a consistent basis for comparison; these are presented in Appendix A of the ASFS. The costs presented in this ROD are based on the Agencies' cost estimates. The Agencies' estimates for Alternatives 11M or 13M include many common components but differ in some aspects from those prepared by Intalco for Alternatives 11 and 13M (URS 2009a). The areas of difference are discussed in detail in Appendix A of the ASFS. The Agencies' estimate for Alternative 11M includes *in situ* treatment and consolidation of impacted soil from some areas that were not considered by Intalco; also the Agencies estimated cost for regrading and stabilizing the tailings piles using the approach Intalco presented for Alternative 13M, which is different from the approach Intalco used for Alternative 11. The Agencies also used different assumptions from Intalco's assumptions, primarily regarding costs for construction labor, supervision, construction mobilization and demobilization, and groundwater treatment costs. The Agencies' estimate for Alternative 13M includes differences from Intalco in the areas of construction mobilization and demobilization, tailings pile stabilization, groundwater treatment and waste disposal, as well as operations, maintenance and monitoring.

[22] The net present value for long-term costs was calculated using a discount rate of 7 percent and a period of 50 years.

Alternative 13M would cost less than Alternatives 11M and 14, as discussed in the ASFS. However, Alternative 13M omits remedy components necessary to satisfy the threshold criteria under CERCLA (or MTCA), so its relative cost would be misleading in selecting a remedy. Alternative 13M costs less than Alternatives 11M and 14 because it does not achieve the same degree of protectiveness as Alternatives 11M and 14, and does not meet ARARs. Alternative 13M would represent an interim step toward a final remedy. It does not take into account the costs of the remaining steps to achieve a final remedy.

10.1.3 Modifying Criteria

Two additional criteria, referred to as modifying criteria, are also considered for remedy selection under CERCLA. These are state acceptance and community acceptance. CERCLA uses the modifying criteria, along with the primary balancing criteria, to determine what is the most appropriate among alternatives that are both protective and ARAR-compliant, see 40 C.F.R. § 300.430(f)(1)(ii).

The State of Washington provided input throughout the RI/FS process and concurs with and supports the Selected Remedy described in this ROD. Through Ecology, the state is adopting this ROD as a cleanup action plan (CAP) under MTCA, pursuant to WAC 173-340-380(4).

Members of the public, including Intalco and Holden Village residents commented on the Proposed Plan. More than 900 comments were received and were considered by the Agencies as discussed in Part 3 of this ROD.

The majority of the comments were submitted on behalf of Intalco or on behalf of Holden Village. The Agencies indexed each comment and sorted them into 75 categories so that similar comments could be addressed in a consistent way. There were 10 or fewer comments in most categories, but there were more than 50 comments in a few of the categories.

Many of the comments addressed reasons why the commenter believed Alternative 13M would be a more appropriate basis for the selected remedy than Alternative 14; for example there were 17 comments that addressed how or why the comment writer believed Alternative 13M satisfies the state's requirements for AKART. Alternative 13M does not meet the CERCLA threshold criteria of protecting human health and the environment and meeting ARARs, as discussed in more detail in Section 10.1 of this ROD and in the response to comments (Part 3).

Many comments also addressed the desirability of minimizing adverse impacts of remedy construction on Holden Village's operations. The Agencies divided the remedy into two phases to reduce impacts to Holden Village's operations (see the discussion of Remedy Phasing in Part 1 of this ROD for further details). The Agencies expect to work with Holden Village and Intalco throughout remedy design and implementation to consider and address potential adverse impacts.

Based on the comments received, the Agencies modified the Preferred Alternative slightly to create the Selected Remedy, as discussed in Section 14 of the ROD, in conformance with the NCP [40 C.F.R. § 300.430(f)(4)(i)]. The most important change was reassessment of soil cleanup levels in some areas of interest through consideration of plant and animal tissue data as indicated in Section 7.1 of the ROD, and discussed in more detail in Houkal and Dagel (2011). As a result of this reassessment, the Selected Remedy does not require *in situ* treatment in the Wind-blown Tailings Area, and changes the remedy for the Ballfield Area from *in situ* soil treatment, as presented in the Proposed Plan, to a combination of hot spot investigation/removal along with possible *in situ* treatment.

10.1.4 Summary of Rationale for the Selected Remedy

The Agencies selected a final remedy based on information presented in the Administrative Record and considering public comments on the Proposed Plan as documented in this ROD. As outlined in Sections 10.1.1 and 10.2.1, Alternatives 11M and 14 both satisfy the threshold criteria for selection of a remedy under CERCLA and MTCA, but differ in their ability to satisfy some of the primary balancing criteria. Overall, Alternative 14 provides the best balance of the criteria and is the basis for the Selected Remedy.

The main advantages of Alternative 14 are as follows:

- Alternative 14 avoids long-term, potentially permanent habitat loss near the Honeymoon Heights Waste Rock Piles and the DSHH area, and for construction of the access road to remove waste rock and impacted soil on Honeymoon Heights. Alternative 14, therefore, would avoid long-term, possibly permanent, habitat degradation to an estimated 70 acres downslope of the Honeymoon Heights access road and waste rock piles, caused by changes in drainage and instability. Unlike Alternative 11M, Alternative 14 uses *in situ* treatment of soil in these areas, which would not require heavy equipment access or involve significant soil disturbance.

- Alternative 14 involves less risk of tailings releases to surface water during construction than Alternative 11M. Unlike Alternative 11M, Alternative 14 does not involve as much regrading and excavation immediately adjacent to Railroad Creek to relocate the toe of the tailings piles.

- Alternative 14 involves less risk of sedimentation or bentonite/cement release to surface water during construction because barrier walls would not be constructed immediately adjacent to Railroad Creek as they would under Alternative 11M.

- The soil caps used on the tailings piles and East and West Waste Rock Piles would be easier to maintain and repair than the membrane liner system used in Alternative 11M.

- Alternative 14 would cost less than Alternative 11M, primarily because it does not involve a geomembrane as part of the cap for tailings and waste rock piles, and removal of the Honeymoon Heights Waste Rock Piles and impacted soil in the DSHH area.

- Alternative 14 would prevent the long-term destruction of habitat over a large area on the steep slopes of Honeymoon Heights and other specified areas of high-value, late successional reserve habitat. As discussed in Sections 1.3, 3.2, and 4.2 of the ASFS, the adverse effects to terrestrial receptors from waste rock and impacted soil above cleanup levels on Honeymoon Heights extends over an area of about 8 acres, compared to an area of about 78 acres (roughly ten times larger) that would be permanently impacted by disturbance and long-term erosion on steep slopes to remove or cap these areas. Similarly, the advantage of removing the waste rock and soil to limit human exposure to hazardous substances would be outweighed by the accompanying long-term destruction of terrestrial habitat, especially in light of the expected effectiveness of institutional controls to control human exposure.

Based on the information currently available, the Agencies believe that the Selected Remedy, based on Alternative 14, meets the threshold criteria and provides the best balance of tradeoffs of the other alternatives with respect to the primary balancing criteria. As described above, the Forest Service and EPA expect the Selected Remedy (based on Alternative 14) to satisfy the following statutory requirements of CERCLA 42 U.S.C. § 9621(b) & (d): 1) be protective of human health and the environment; 2) comply with ARARs except where a waiver is justified; 3) be cost-effective; 4) use permanent solutions and alternative treatment technologies to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element or justify why the preference is not satisfied.

10.2 Evaluation of Alternatives under MTCA

The State of Washington is concurrently exercising its independent cleanup authority for this Site under MTCA, which is applicable to the Site under state law [RCW 70.105D]. The following discussion is prepared solely for the state's benefit in adopting this ROD as a cleanup action plan under MTCA [see WAC 173-340-380(4)]. It is not a part of the CERCLA decision-making process.

As with CERCLA, the MTCA threshold requirements must be met for an alternative to be considered further. The nine additional requirements (and action-specific), along with the four threshold requirements, used to evaluate alternatives that satisfy the threshold criteria [WAC 173-340-360(2)] include the following:

Threshold Requirements

1) Protect human health and the environment

Similar to CERCLA, the alternative must provide for overall protection of human health and the environment.

2) Comply with cleanup standards

Similar to CERCLA, the alternative must comply with cleanup standards (cleanup levels and the points of compliance where such cleanup levels must be met) as established in WAC 173-340-700 through 173-340-760.

3) Comply with applicable state and federal laws

Similar to CERCLA, the alternative must comply with both applicable and requirements that are determined to be relevant and appropriate, as defined through WAC 173-340-710.

4) Provide for compliance monitoring

Similar to CERCLA, the alternative must provide for compliance monitoring, as established under WAC 173-340-410 and WAC 173-340-720 through 173-340-760.

Other Requirements

1) Use permanent solutions to the maximum extent practicable

The determination of whether an alternative uses permanent solutions to the maximum extent practicable is based on an evaluation of: 1) overall protectiveness of human health and the environment, including consideration of the degree of risk reduction, the time required to reduce risk and attain cleanup levels, on-site and off-site risks resulting from implementing the alternative, and improvement of overall environmental quality resulting from the alternative; 2) permanence, as measured by the degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances; 3) cost, including the cost of construction and the net present value of any long-term costs, such as those associated with operation and maintenance; 4) effectiveness over the long term, including the degree of certainty that the alternative will be successful; 5) management of short-term risks; 6) technical and administrative implementability; and 7) consideration of public concerns. The costs and benefits of each alternative, as defined by the preceding evaluation criteria, are compared in what is referred to as a "disproportionate cost analysis." Only those alternatives meeting threshold requirements are subject to this analysis. Where two or more alternatives are equal in benefits, Ecology is to select the less costly alternative. Costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the other lower cost alternative. This comparison of costs to benefits may be quantitative, but may also be qualitative. Ecology has discretion to favor or disfavor qualitative benefits and utilize its best professional judgment in making such determinations. For complete detail, see WAC 173-340-360(3).

2) Provide a reasonable restoration time frame

The determination of whether an alternative provides for a reasonable restoration time frame is based on an evaluation of: 1) potential risks posed by the site to human health and the environment; 2) practicability of achieving a shorter restoration time frame; 3) current use of the site, surrounding areas, and associated resources that are or may be affected by releases from the site; 4) potential future use of the site; 5) availability of alternative water supplies; 6) likely effectiveness and reliability of institutional controls; 7) ability to control and monitor migration of hazardous substances from the site; 8) toxicity of the hazardous substances at the site; and 9) natural processes that reduce concentrations of hazardous substances. A longer time period may be used for the restoration time frame if the alternative selected has a greater degree of long-term effectiveness than on-site or off-site disposal, isolation, or containment options. Extending the restoration time frame cannot be used as a substitute for active remedial measures when such actions are practicable. For complete detail, see WAC 173-340-360(4).

3) Consider public concerns

Action-Specific Requirements ("pertaining to" requirements)

1) Groundwater cleanup actions

Where a permanent cleanup action is not practicable (i.e., cleanup levels for groundwater cannot be achieved throughout the Site within a reasonable restoration time frame), then 1) treatment or removal of the source of the release shall be conducted for liquid wastes, areas contaminated with high concentrations of hazardous substances, highly mobile hazardous substances, or hazardous substances that cannot be reliably contained; and 2) groundwater containment shall be implemented to the maximum extent practicable to avoid lateral and vertical expansion of the groundwater volume affected by the hazardous substance. For complete detail, see WAC 173-340-360(2)(c).

2) Soil at current or potential future residential areas and child care centers

Specific requirements pertaining to soil cleanup at current or potential future residential areas and child care centers are found in WAC 173-340-360(2)(b). These requirements (which relate to soil cleanup levels established for human health protection) are not triggered at the Holden Mine Site.

3) Institutional controls

Institutional controls must comply with the specific requirements of WAC 173-340-440 and should demonstrably reduce risks to ensure a protective remedy. A remedy shall not rely primarily on institutional controls and monitoring where it is technically possible to implement a more permanent cleanup action for all or part of a site. For complete detail, see WAC 173-340-360(2)(e).

4) Releases and migration

Cleanup actions shall prevent or minimize present and future releases and migration of hazardous substances in the environment. See WAC 173-340-360(2)(f).

5) Dilution and dispersion

Cleanup actions shall not rely primarily on dilution and dispersion unless the incremental costs of any active remedial measures over the costs of dilution and dispersion grossly exceed the incremental degree of benefits of active remedial measures over the benefits of dilution and dispersion. See WAC 173-340-360(2)(g).

6) Remediation levels

Remediation levels are defined as the particular concentration of a hazardous substance in any media, above which a particular cleanup action component will be required as part of a cleanup action at the Site. See WAC 173-340-200. Specific requirements pertaining to the use of remediation levels are presented in WAC 173-340-360(2)(h). However, as noted below, remediation levels are not proposed in any of the alternatives analyzed in this ROD.

10.2.1 Threshold Requirements

The threshold requirements for selection of a remedy under MTCA are that a cleanup action:

- Protect human health and the environment;
- Comply with cleanup standards
- Comply with applicable state and federal law; and
- Provide for compliance monitoring.

Protect Human Health and the Environment

For the same reasons that Alternative 14 and Alternative 11M provide for "overall protection of human health and the environment" under CERCLA (see Section 10.1.1.1), Alternative 14 and Alternative 11M satisfy MTCA's requirement that the remedy protect human health and the environment. Alternative 13M would be protective of human health, but would not protect terrestrial receptors in many areas of the Site. The Agencies do not have sufficient information to show that surface water cleanup levels would be met in groundwater that discharges to surface water downstream of Tailings Piles 2 and 3 without a barrier wall. Investigations to date indicate extensive impacts to surface water quality and aquatic life adjacent to and downgradient of the mine from groundwater discharges, including groundwater migrating from Tailings Piles 2 and 3.

Comply with Cleanup Standards

As presented in the ASFS Sections 6.3.1 and 6.3.3, Ecology concludes that Alternatives 11M and 14 would comply with cleanup standards for groundwater, surface water, sediment, and soil. Under Alternative 11M, contaminated groundwater would be contained and treated before entering the surface water. Alternative 14 also includes a groundwater barrier for this purpose that would be constructed in two phases. However, the second phase barrier could be modified or not constructed if certain demonstrations are made by Intalco, as previously described in Section 4.3. Ecology concludes that Alternative 13M does not satisfy cleanup standards under MTCA, as discussed in ASFS Section 6.3.2. Under MTCA, a conditional POC for groundwater may be established where the Site abuts surface water, provided specific criteria are met, [see WAC 173-340-720(8)(d)(i)]. Where groundwater discharges to surface water, the conditional POC under MTCA must be as close as practicable to the source [WAC 173-340-720(8)(c)], but no further within surface water than as close as technically possible to the point or points where groundwater flows into the surface water [WAC 173-340-720(8)(d)(i)]. Among the criteria to be met, MTCA requires that for a cleanup action to qualify for a groundwater conditional POC at the groundwater-surface water interface, groundwater discharges must receive all known available and reasonable methods of treatment (AKART) before release to surface water. As established in the FS, the groundwater barrier walls that are part of Alternatives 11M and 14 satisfy this AKART requirement, and in fact are expected to result in groundwater achieving surface water cleanup levels before entering the portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates, so as to be protective of aquatic life . The limited groundwater barrier wall configuration under Alternative 13M does not satisfy AKART, because this remedy does not include containment of groundwater underneath Tailings Piles 2 and 3, and there is no evidence that groundwater cleanup levels, based on protection of surface water, would be met before groundwater enters Railroad Creek downstream of Tailings Piles 2 and 3. As a result, Ecology cannot approve a conditional POC under the criteria of WAC 173-340-720(8)(c) and (d) for Alternative 13M. Alternative 13M also does not satisfy cleanup standards under MTCA for soil in several areas of the Site.

Comply with State and Federal Law

For the same reasons that Alternative 14 and Alternative 11M comply with ARARs under CERCLA (see Section 10.1.1), Alternative 14 and Alternative 11M satisfy MTCA's requirement that the remedy comply with applicable state and federal laws. Alternative 13M does not comply with all applicable state and federal laws.

Provide for Compliance Monitoring

Alternatives 11M, 13M, and 14 would each provide for compliance monitoring.

Summary of MTCA Threshold Requirements

As noted in Section 10.1.1, Alternatives 14 and 11M would satisfy the MTCA threshold requirements for selection of a final remedy, but Alternative 13M would not (this is more fully discussed in Sections 6.2.2 and 6.3.2 of the ASFS).

As is the case with CERCLA, alternatives that do not meet the MTCA threshold criteria are not carried forward for further remedy selection comparison (e.g., using the other MTCA requirements). Alternatives 14 and 11M do meet the threshold criteria and, therefore, are carried forward. Although Alternative 13M does not meet the threshold criteria under MTCA, it is also carried forward in the following discussion for completeness and to better compare and understand these three alternatives.

10.2.2 MTCA Other Requirements

Under MTCA, the other requirements for remedy selection require that a cleanup action shall:

- Use permanent solutions to the maximum extent practicable;
- Provide for a reasonable restoration time frame; and
- Consider public concerns.

Alternatives 11M and 14 would both largely satisfy the other requirements for remedy selection under MTCA, but with some differences as summarized below.

Use Permanent Solutions to the Maximum Extent Practicable

Alternative 13M does not address soil exceeding cleanup levels in several areas of the Site and, therefore, cannot be considered permanent for these areas. Alternative 13M also would not prevent groundwater exceeding cleanup levels from entering Railroad Creek downgradient of Tailings Piles 2 and 3. Based on the analysis in Appendix D of the ASFS and Appendix C of the SFS, the Agencies have concluded it is practicable to provide for the containment, collection, and treatment of this groundwater.

- Sections 10.1.2 through 10.1.4 of the ROD provide an extensive discussion of the differences and resulting tradeoffs between Alternatives 14 and 11M. When these differences and tradeoffs are analyzed under the seven evaluation criteria of MTCA's disproportionate cost analysis, Ecology concludes that:

- Alternative 14 is more protective than Alternative 11M;

- Alternative 11M is slightly more permanent than Alternative 14, but at a greater environmental cost;

- Alternative 14 has a lower cost than Alternative 11M;

- Alternative 14 has greater effectiveness over the long term than Alternative 11M;

- Alternative 11M has slightly greater short-term risks than Alternative 14;

- Alternative 11M and Alternative 14 have essentially the same technical and administrative feasibility; and

- The Agencies have the same ability to address public concerns for both Alternative 11M and Alternative 14.

On the whole, Alternative 14 is considered to be more protective and reliable over the long term than Alternative 11M. Alternative 14 requires less operation and maintenance, results in less disturbance to valuable habitat, uses less energy and materials to operate, and is more sustainable, all at a lower overall cost. Alternative 14, therefore, best satisfies the requirement that a remedy be permanent to the maximum extent practicable.

Provide for a Reasonable Restoration Timeframe

Alternative 11M would have a shorter restoration time frame compared to Alternative 14 for cleanup of the Honeymoon Heights Waste Rock Piles and DSHH. However, this would only be achieved by measures more intrusive than *in situ* treatment, and such measures appear likely to cause more adverse impact (permanent habitat loss or damage) than the existing hazardous substance concentrations in these AOIs. Alternative 14 would have a slightly longer restoration time frame compared to Alternative 11M for the area subject to the second phase barrier wall; however, the Agencies believe this is justified based on consideration of the RAOs. The restoration time frame for the remaining AOIs would be the same under both Alternatives 11M and 14. Alternative 13M does not provide a reasonable restoration time frame because it does not address soil exceeding cleanup levels in several areas of the Site and would not prevent groundwater exceeding cleanup levels from entering Railroad Creek downgradient of Tailings Piles 2 and 3.

Public Concerns

Public concerns were addressed in Section 3 of this ROD.

10.2.3 MTCA Action-Specific Requirements

Non-Permanent Groundwater Cleanup Actions

As discussed in the final Feasibility Study, a permanent groundwater cleanup is not practicable throughout the entire Site within a reasonable restoration time frame. Therefore, the selected alternative must meet MTCA's requirements for non-permanent cleanup actions.

Alternatives 11M and 14 include the removal, containment, or *in situ* treatment of the sources of hazardous substances at the Site. These alternatives also include groundwater containment to the maximum extent practicable to avoid lateral and vertical expansion of the groundwater affected by the hazardous substances. For impacted soil (including tailings and waste rock), consolidation, containment, *in situ* treatment and, possibly, removal are remedy components. As a result, Alternatives 11M and 14 meet the MTCA requirements for a non-permanent groundwater cleanup action.

Alternative 13M includes the removal or containment of some sources of hazardous substances but does not address all soil at the Site that exceeds cleanup levels. Also, Alternative 13M does not include groundwater containment to the maximum extent to avoid expansion of the plume. As a result, Alternative 13M does not satisfy the MTCA requirements for non-permanent groundwater cleanup actions.

Soil Cleanup for Residential and School Areas

As indicated above, these requirements are not triggered at the Holden Mine Site because Holden Village-area soil does not exceed human health standards.

Institutional Controls

Ecology concludes that Alternatives 11M and 14 each satisfies requirements for institutional controls to protect human health that are specified in WAC 173-340-440. However, Alternative 13M relies on more extensive use of institutional controls rather than more permanent cleanup actions to protect human health for a portion of the Site (i.e., in the Ballfield Area and Lower West Area AOIs).

Releases and Migration/Dilution and Dispersion

Ecology concludes that Alternatives 11M and 14 prevent the release and migration of hazardous substances to the maximum extent practicable and do not rely primarily on dilution and dispersion to clean up groundwater and surface water that exceed cleanup levels. However, it appears that Alternative 13M relies on dilution and dispersion east of Tailings Pile 3 to prevent the discharge of groundwater that exceeds cleanup levels to surface water.

Remediation Levels

Alternatives 11M and 14 do not propose the use of remediation levels.

Intalco refers to remediation levels in discussing Alternative 13M, but the Agencies believe Intalco is using this term to refer to site-specific, risk-based cleanup levels, as discussed in the ASFS.

11.0 PRINCIPAL THREAT WASTE

The NCP establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practical. A principal threat concept is applied to the characterization of "source material" at a site. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act a reservoir for migration of contaminants to groundwater, surface water, or air, or acts as a source for direct exposure. EPA has defined Principal Threat Wastes as those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk (e.g., a potential risk of $10^{-3,}$ or greater) to human health or the environment should exposure occur. EPA guidance also says that contaminated groundwater is generally not considered to be a source material or a principal threat waste. Based on these considerations, there are no Principal Threat Wastes at the Site.

12.0 THE SELECTED REMEDY

12.1 Summary of the Rationale for the Selected Remedy

The Selected Remedy meets the threshold criteria and provides the best balance of tradeoffs of the other alternatives with respect to the primary balancing criteria. In addition to being protective and complying with ARARs, the principal factors that led to this selection include in summary:

- **Long-Term Effectiveness.** The selected remedy avoids long-term, potentially permanent habitat loss near the Honeymoon Heights Waste Rock Piles and the DSHH area, and for construction of the access road to remove waste rock and impacted soil on Honeymoon Heights. Also, the soil caps used on the tailings piles and East and West Waste Rock Piles would be as effective and easier to maintain and repair than other alternatives.

- **Short-Term Effectiveness.** The selected remedy involves less short-term risk of tailings, sediment, or bentonite/cement releases to surface water during construction than other alternatives.

- **Cost.** The selected remedy is the most cost-effective protective alternative.

12.2 Description of the Selected Remedy

This section expands on the description of the Selected Remedy for each area at the Site. The Selected Remedy is based on Alternative 14 with modifications discussed in Section 14 of the ROD. The Selected Remedy may change somewhat during the remedial design and construction processes. Any significant changes to the remedy described in the ROD will be documented using an Explanation of Significant Differences (ESD) or a ROD Amendment.

Table 22, below, summarizes the estimated costs for the Selected Remedy.

Table 22 - Estimated Costs for the Selected Remedy

Selected Remedy	
Estimated Capital Cost	$76,100,000
Net Present Value of Long-Term Operations, Maintenance, and Monitoring	$30,700,000
Total Estimated Cost:[23]	$107,000,000

Figure 18 shows the principal components of the Selected Remedy. Design details for several components of the Selected Remedy will be determined during remedial design. These include final slope grade for the tailings piles and main waste rock piles, design of caps to isolate contaminated materials, final design of the groundwater treatment facilities, Railroad Creek relocation, and *in situ* soil treatment.

12.2.1 Soil

The Selected Remedy includes consolidation of soil that exceeds cleanup levels from most areas of the Site into the tailings piles, and capping the tailings and waste rock piles to isolate these materials from the environment and manage them in place. In some areas, (e.g., the Lagoon, other portions of the Lower West Area, the Maintenance Yard, and the Ballfield Area), further characterization is needed to determine the extent of soil that needs to be

---

[23] Costs are shown in 2010 dollars, rounded to three significant figures. The net present value of future operations, maintenance and monitoring costs were estimated using a discount rate of 7 percent and period of 50 years. See Appendix A of the ASFS for more information.

removed, capped in place, or treated in place. Capping or soil removal is not proposed in certain critical and sensitive areas or existing topographic conditions where the Agencies believe those actions will cause more ecological harm (e.g., permanent habitat destruction) than the threat posed by existing site contamination. As a result, cleanup in some AOIs includes *in situ* soil treatment to reduce the mobility and bioavailability of hazardous substances. During remedial design, treatability tests will be needed to determine the best approach for *in situ* treatment, including application rates to avoid adverse effects on existing habitat. Results of these tests will provide further detail on the degree and timing of protectiveness that can be achieved with this approach.

AOIs where *in situ* treatment is proposed include: Honeymoon Heights Waste Rock Piles, the DSHH, portions of the Lower West Area, Holden Village, and possibly portions of the Ballfield Area (see Figure 18). Pending completion of *in situ* treatability studies, the effectiveness of this approach is not as certain as removal or capping. Potentially, *in situ* treatment may require more time than an approach with a significant adverse impact, or it may not fully attain cleanup levels. Where *in situ* treatment would not immediately prevent risk to human health (e.g., portions of the Lower West Area and Honeymoon Heights), the Selected Remedy would include signage to warn of human health risks in such areas. CERCLA provides for an ARAR waiver and selection of a remedy that does not attain an ARAR if the administrative record supports a finding that compliance at a given site or portion of a site will result in greater risk to human health and the environment than alternative options. If appropriate, waiver of the cleanup standard in this situation would occur through a ROD Amendment.[24]

Tailings Piles 1, 2, and 3

The following actions will be taken to contain and manage the waste that will remain in Tailings Piles 1, 2, and 3 after the completion of the remedy. The tailings pile slopes will be regraded so they are stable under steady state and

---

[24] For Ecology's purposes under MTCA, the environmental risk of the cleanup action may be considered as part of a disproportionate cost analysis to determine whether a cleanup action is permanent, to the maximum extent practicable. Washington's State Environmental Policy Act (SEPA) also provides Ecology with substantive authority, subject to certain provisions, to modify a cleanup action to mitigate adverse environmental impacts.

seismic (maximum design earthquake) conditions, are contoured to promote maximum runoff and reduce infiltration, and comply with ARARs. This will include construction of benches for erosion control and, possibly, buttressing. Before regrading, a portion of Railroad Creek will be diverted northward into a new channel, which will also reduce the risk of long-term erosion or scour of the slopes that will release hazardous substances into Railroad Creek. Portions of the toes of Tailings Piles 1 and 2 will be pulled back from Copper Creek and from portions of Railroad Creek as determined necessary by the Agencies.[25] In addition, the Copper Creek channel will be improved to reduce the risk of adversely impacting Tailings Piles 1 and 2.

The three tailings piles will be capped with a cover consisting of soil and/or other materials designed to contain the tailings, reduce exposure to the environment, eliminate unacceptable risk to terrestrial plants and animals and to satisfy ARARs, including the state's performance requirements for closure of limited purpose landfills and Forest Service standards and guidelines. Soil with hazardous substances that are consolidated from other portions of the Site (described below), and possibly excess waste rock from regrading the East and/or West Waste Rock Piles, will be consolidated onto the tailings piles before capping.

East and West Waste Rock Piles

The following actions will be taken to contain and manage the waste that will remain in the East and West Waste Rock Piles after the completion of the remedy. The East and West Waste Rock Pile side slopes will be regraded to configurations that are stable under steady state and seismic conditions and contoured to promote maximum runoff and reduce infiltration. The top and side slopes of the waste rock piles will then be capped with a cover consisting of soil and/or other materials designed to contain the waste rock, reduce exposure to the environment, eliminate unacceptable risk to terrestrial plants and animals, and to satisfy ARARs.

---

[25] This may be needed to provide sufficient room for construction of other remedy components, such as the groundwater containment and collection system, and to address potential risk of erosion and scour. The need for such actions would be determined during remedial design.

Honeymoon Heights Waste Rock Piles (Including DSHH)

The following actions will be taken to contain and manage the waste that will remain in the Honeymoon Heights Waste Rock Piles after the completion of the remedy. The Honeymoon Heights Waste Rock Piles and DSHH AOIs will be cleaned up using *in situ* treatment to reduce bioavailability and mobility of hazardous substances by adjusting pH, to the extent practicable, without degrading existing habitat. The method and rate of application, frequency of treatment, and other aspects will be determined based on treatability tests conducted during remedial design and on post-implementation monitoring. Institutional controls including access warning signs will also be implemented in these areas to address potential human health risks from lead and arsenic.

Ballfield Area

Areas of soil with hazardous substances exceeding cleanup levels will be removed based on the results of further characterization and consolidated into the tailings piles prior to capping. The area will then be revegetated with native vegetation. *In situ* treatment may also be used if further characterization indicates that hazardous substances extend into adjacent areas of late succession riparian habitat.

Holden Village

Soil will be remediated using *in situ* treatment to reduce risk to soil invertebrates resulting from zinc. Institutional controls will be developed and implemented, including a soil management plan to address handling of soil with visible tailings that may be excavated in the future and a requirement for consultation with the Agencies prior to changes in land use to ensure that the remedy remains protective.

Lower West Area, including the Lagoon Area

Impacted soil in some locations (including the Lagoon Area and soil with hazardous substances in existing disturbed areas) will be capped and managed in place or removed and consolidated into the tailings piles prior to capping. The extent of soils to be capped in place or consolidated, and the areas where soils are treated *in situ*, would be determined by additional characterization during remedial design or remedial action. Soil located in areas of late succession riparian habitat (primarily in the Lower West Area-West) will be remediated using *in situ* treatment to limit impacts to this habitat. Institutional controls (e.g., by restrictions in the Forest Service Land Status Records for the Okanogan-Wenatchee National Forest including access warning signs) will also be implemented in the Lower West Area to address human health risks from arsenic, cadmium, copper, and lead in soil.

Wind-Blown Tailings Area

A portion of the impacted soil in the Wind-Blown Tailings Area that contains visible tailings will be removed during the work (such as borrow site development, construction of the groundwater treatment facility, and relocation of Railroad Creek) and consolidated into the tailings piles before capping. Additional removal or *in situ* treatment is not included to limit impacts to the high-value, late succession habitat, since reevaluation of the TEE did not indicate terrestrial risks over the entire area. Institutional controls will be implemented to require a soil management plan to address handling of soil with visible tailings that may be excavated in the future, and consultation with the Agencies prior to changes to land use (e.g., if timber harvesting or other ground-disturbing activity occurs) to ensure that the remedy remains protective.

Maintenance Yard

Soil exceeding cleanup levels in the Maintenance Yard area will be capped and managed in place, or the soil will be consolidated into the tailings piles. Holden Village has requested that the remedy allow continued future land use of this area for vehicle maintenance and parking. The extent of the cap or soil removal will be determined based on additional soil characterization during remedial design.

Former Mill Building

The structural components will be demolished as part of managing contaminated soil and ore processing residuals.[26] If State Dangerous Wastes are encountered, they will need to be disposed of off site in a permitted facility. Contaminated materials (not including Dangerous Wastes) may be capped in place or consolidated with other contaminated materials (e.g., tailings and waste rock) on the Site before capping.

[26] See Appendix A for mitigation required under the National Historic Preservation Act.

Ventilator Portal Surface Water Retention Area Soil

Soil above cleanup levels will be capped and managed in place or excavated from the Ventilator Portal Surface Water Retention Area and consolidated into the tailings piles before capping, depending on results of further analysis during remedial design.

Wetland East of Tailings Pile 3

The Selected Remedy would allow, but not require, location of a groundwater treatment system on the north side of Railroad Creek (see Figure 18) that was analyzed as part of Alternative 11M. If the treatment system is not located in wetland east of Tailings Pile 3 as was contemplated for Alternatives 13M and 14, this wetland will be remediated under the Selected Remedy. This shall include removal of visibly contaminated soil, eliminating the adverse effects of runoff and sediment transport from the tailings pile and shallow contaminated groundwater impacted by leaching from the tailings pile. Mitigation will be required to the extent that the wetland is adversely impacted (temporarily or permanently) by remedial construction.

12.2.2 Groundwater

The Main Portal drainage, along with contaminated seeps (SP-12 and SP-23) downslope from Honeymoon Heights, will be collected and treated. Concentrations of hazardous substances in the Main Portal discharge will be reduced by installing air flow restrictors to reduce airflow through the mine, thus reducing the rate of oxidation of sulfide minerals within the mine. Groundwater will be monitored downslope of Honeymoon Heights to determine whether additional groundwater should be collected for treatment.

Water from the Main Portal drainage and seeps SP-12 and SP-23 will be conveyed and treated in a water treatment facility that will be located and constructed based on approved studies during remedial design.

The other main contaminant source areas (e.g., the tailings piles, main East and West Waste Rock Piles, and the Lower West Area) will be managed in place based on the determination in the final Feasibility Study that it would not be practicable to remove these sources of hazardous substances that are impacting groundwater, or to achieve groundwater cleanup levels within these areas within a reasonable restoration timeframe. Management of these wastes in place includes the construction of groundwater containment barrier walls around the tailings piles, which is necessary to prevent further migration of contaminants in groundwater and to protect downgradient surface water. Groundwater from these source areas will be contained and collected for treatment to prevent migration and discharge to surface water. The tailings and the main waste rock piles will also be capped, and the smaller Honeymoon Heights waste rock piles and impacted soil areas will be treated *in situ*.

The NCP preamble language sets forth the EPA's policy that for groundwater, "remediation levels generally should be attained throughout the contaminant plume, or at and beyond the edge of the waste management area when waste is left in place." The NCP preamble also indicates that in certain situations it may be appropriate to address the contamination as one waste management area for purposes of the groundwater point of compliance; for example this may be protective of public health and the environment at certain sites where there are multiple sources from closely spaced waste management areas. The selected remedy establishes two WMAs, with the Lower West Area including the Tailing Pile 1, the mill, and the East and West Waste Rock Piles as one WMA, and Tailings Piles 2 and 3 as a second. The Selected Remedy includes restoration of groundwater to beneficial uses and associated cleanup levels (MCLs) at and beyond the edge of each WMA. Groundwater points of compliance for meeting MCLs are established at the edge and beyond each WMA. Monitoring for compliance with drinking water standards shall be accomplished outside the WMA, as close as practicable to the edge of the WMA. Institutional controls will be implemented to present use of the groundwater as drinking water within the WMAs.

CERCLA and MTCA both require protection of all affected media and receptors, including those aquatic receptors in the hyporheic zone[27]. Cross-media impacts must be considered and cleanup levels must be established at concentrations that prevent violations of cleanup levels for other media (WAC 173-340-700(6)(b) and 173-340-702(8)). At the Holden Mine Site, this means that cleanup levels established for the protection of aquatic life must be achieved before the portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates, and not simply in the surface

---

[27] The hyporheic zone is the transition zone between surface water and groundwater. Within this zone, exchanges of water, nutrients, and organic matter occur in response to variations in discharge and stream bed topography and porosity; portions of this zone support aquatic life (see Boulton et al. 1998).

water column after dilution has occurred.[28] Based on this, a POC for groundwater entering into surface water (which is a conditional POC under MTCA) is established within groundwater before (i.e., hydraulically upgradient of) the groundwater–surface water interface.[29] Groundwater quality at this POC shall be monitored using upland monitoring wells.

A fully penetrating groundwater containment barrier wall and collection system will be constructed for the Lower West Area and the tailings piles as generally depicted on Figure 18. The alternatives addressed in the final Feasibility Study contemplated that the groundwater barrier would be constructed using the slurry trench method with a mix of soil and bentonite or soil, cement, and bentonite. The final design of the barrier wall and its southerly extent (e.g., between Tailings Piles 1 and 2, and on the east side of Tailings Pile 3) would be determined during remedial design for the Selected Remedy. During the first phase of remedy implementation, the barrier system will extend from Copper Creek west to where the Main Portal drainage currently discharges into Railroad

---

[28] Based on the analysis in the FS, the containment provided by the groundwater barrier walls in the Selected Remedy will result in groundwater achieving cleanup levels established for the protection of aquatic life within groundwater before the groundwater enters the portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates. A conditional POC at this point is thus "as close as practicable to the source of hazardous substances" under MTCA [WAC173-340-720(8)(c)] and appropriate at the Holden Mine Site, as further described in the text body. WAC 173-340-720(8)(d)(i), which, provided certain criteria are met, allows for a conditional POC that is located within the surface water as close as technically possible to the point or points where groundwater flows into the surface water, is not triggered by the Selected Remedy, since it is practicable to meet the cleanup level at a point within the groundwater before entering the surface water.

[29] The interface is where groundwater first contacts surface water. The depth of the interface is not static (e.g., it may vary from seasonal or other changes in gradient) or uniform in depth across a plume (e.g., based on preferential pathways, areas of upwelling versus downwelling). Taking this into account, the POC for groundwater discharging to surface water at this Site requires compliance monitoring points located within groundwater upgradient of the interface (as detected through geochemical, thermal, biologic activity, or other means). Monitoring for the POC shall use upland wells. The depth and location of the POC must take into account year-round variations in the groundwater-surface water interface.

Creek. This system will intercept impacted groundwater that would otherwise enter Railroad Creek and Copper Creek from the Lower West Area and Tailings Pile 1. Water collected from this system will be conveyed to a treatment facility.

During the second phase of remedy implementation, a second fully penetrating barrier wall and collection system will be constructed downgradient of Tailings Piles 2 and 3.

The period between the first and second phase presents an opportunity for Intalco to collect data in an effort to support a proposal to modify the second phase. The ROD allows for the collection of additional data following implementation of the first phase cleanup components, and includes the provision that the barrier wall design could be modified or would not need to be installed, if demonstrated to satisfy ARARs and be protective within a timeframe comparable to the Selected Remedy. The second phase of the remedy would not need to be installed only if it can be demonstrated to the Agencies' satisfaction that:

1. Groundwater concentrations are reduced to achieve surface water cleanup levels before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates; and

2. One of the following: a) groundwater meets MCLs below Tailings Piles 2 and 3, as well as throughout the plume; or b) groundwater that exceeds drinking water standards will be contained within a WMA; or c) an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective is justified.

Such a change would require a ROD Amendment. The basis for the change must be demonstrated within 3 years of substantial completion of the first phase of remedial construction, so that a decision can be made in the fourth year. Unless the second phase groundwater barrier and collection system is eliminated, the second phase of remedial action is expected to be designed in the fifth year and constructed immediately thereafter.

12.2.3 Surface Water

Surface water will be addressed by preventing the erosion of tailings and stopping the discharge of contaminated runoff and groundwater (including seeps and discharge from the Main Portal) into surface water, including Railroad Creek, Copper Creek, and the Copper Creek Diversion. The Selected Remedy includes the following actions to clean up surface water:

- Stabilizing the tailings pile slopes, contouring the tailings and waste rock piles to promote maximum runoff and reduce infiltration, diverting Railroad Creek away from the toes of the tailings piles, and modifying the Copper Creek Diversion and the Copper Creek channel to prevent release of tailings into surface water;

- Capturing and treating impacted groundwater from the Main Portal and Honeymoon Heights seeps; and

- Containing and treating impacted groundwater from the Lower West Area and Tailings Piles 1, 2, and 3.

Relocation of some portion(s) of Railroad Creek will enable construction of the groundwater barrier and collection system, and reduce the risk of slope instability from erosion or scour undermining the tailings piles slopes. The new channel will have an impervious liner where needed to prevent infiltration of clean water into contaminated groundwater that will be collected adjacent to the tailings piles.

The extent of stream relocation and tailings regrading will be assessed during remedial design. Although it would be possible to relocate a portion of Railroad Creek in each phase of remedial construction, the Selected Remedy requires creek relocation in a single construction effort in the first phase. A single-phase of creek relocation rather than two phases has the following advantages.

Relocation of Railroad Creek during the first phase of construction will:

- Reduce or eliminate the risk that regrading the slopes of Tailings Piles 2 and 3 would cause a release of tailings into the creek.

- Provide room for construction of a toe buttress and/or ground improvements adjacent to the toe of the tailings piles, which will be needed for stabilizing the regraded tailings pile slopes.

- Avoid the adverse effects of creek relocation of a second phase (e.g., sediment due to construction) on downstream aquatic life; and

- Reduce or avoid potential conflicts between a second-phase creek realignment and the new vehicle bridge and groundwater treatment plant near Tailings Pile 3.

Stormwater diversion swales and other measures will be constructed upgradient from Tailings Piles 1, 2, and 3 and the East and the West Waste Rock Piles, to control surface water run-on.

12.2.4 Sediment

The Selected Remedy will permanently relocate a portion of Railroad Creek to eliminate the effects of ferricrete on aquatic receptors and provide a natural channel substrate. The Selected Remedy also includes permanent containment of groundwater that has concentrations of iron and aluminum that produce floc in Railroad Creek to address this source of hazardous substances in creek sediment and the water column in the channel downstream of the mine.

Monitoring in Railroad Creek and at the Lucerne Bar in Lake Chelan along with bioassays based on the most current Agency protocols will determine whether the remedy is protective of sediment quality.

12.2.5 Other Remedial Components

The Selected Remedy also includes the following features:

- Construction of limited-purpose landfill(s) for disposal of remediation-derived waste.[30]

---

[30] Remediation-derived waste for the Holden Site cleanup is defined as: 1) tailings, waste rock, and soil impacted by tailings and/or waste rock that is excavated as part of the cleanup; 2) water treatment system sludge; 3) Holden Village's former municipal solid waste landfill and sewage treatment pond waste that may be encountered when regrading the tailings piles; 4) debris from existing structures that must be removed in order to allow for remedy implementation (such as structural steel and other materials from demolition of the Mill Building); and 5) other mine-related debris that will be disturbed as part of the remedy. The on-site waste disposal would need to satisfy ARARs for new waste disposal facilities (e.g., portions of the state's Limited Purpose Landfill requirements for location, design, construction, operation, closure, and monitoring, see WAC 173-350-400). For the Selected Remedy, as under Alternative 14, water treatment

- A groundwater treatment system as described in the final Feasibility Study.[31] Effluent from the treatment facility shall satisfy ARARs including the Biotic Ligand Model for copper, and may include a mixing zone approved in accordance with WAC 173-201A-400.[32] Chemical-specific ARARs for several contaminants of concern depend on the hardness of the receiving water. The surface water ARARs presented in Table 3 are based on a hardness value of 9 mg/L which represents historic measurements at background station RC-6. The assessment of compliance with these ARARs once the remedy has been implemented may include consideration of hardness conditions in the receiving water at that time.

- Development of remedy infrastructure, including quarry site(s), borrow pit(s), reconstruction of the Lucerne barge landing facility, construction work camp, and/or related infrastructure improvements at Holden Village, improvements to the Lucerne-Holden Road including bridges, electric power infrastructure, and other infrastructure, as needed. The Agencies consider development of hydroelectric power generating capacity to be highly desirable.

- Consolidation of tailings as encountered during construction in areas outside the main tailings piles, e.g., within the Wind-Blown Tailings Area, in the Lower West Area, and in the wetlands directly east of Tailings Pile 3.

---

system sludge would be disposed of in a lined on-site landfill designed and constructed for this purpose. The potential use of an unlined sludge disposal facility, possibly on the tailings piles (i.e., within a groundwater containment area) could be further evaluated during remedial design as proposed by Intalco for Alternative 13M. It will also be necessary to plan for future disposal of potentially contaminated soil that may be generated by future excavations in Holden Village and possibly other areas of the Site. This ROD does not allow disposal of Holden Village debris as remediation-derived waste on National Forest System lands (i.e., the debris on top of the West Waste Rock Pile).

[31] MTCA requires that the groundwater treatment system satisfy AKART, WAC 173-340-720(8)(d)(i). The approval of a mixing zone for the treatment facility effluent, or the possible development of site-specific water quality criteria through use of a water effects ratio, would first require satisfying AKART.

[32] Intalco has proposed and the Agencies are open to a Water Effects Ratio (WER) study that may result in modification of the cleanup levels. A change in the cleanup levels based on the WER would be implemented through a ROD Amendment.

- Temporary and/or permanent relocation of Holden Village infrastructure (e.g., portions of the potable water system, maintenance yard, and composting facility) as needed to enable remedial construction.

- Mitigation to address unavoidable adverse impacts of remedy construction such as, but not limited to, replacement of wetlands or floodplains that are filled, and revegetation of disturbed areas with native species to restore existing habitat.

- Sampling and analysis during remedial design to better define the extent of cleanup in areas such as the Lower West Area and the Ventilator Portal Surface Water Retention Area and to investigate the nature and extent of environmental impacts related to: a) potential waste rock on the Lucerne-Holden Road; and b) ore processing residuals in the former Mill Building area. The results of the investigation will be used to develop plans to consolidate and dispose or cap these wastes in place during remedial implementation.

- Institutional controls that would be implemented by the notation of restrictions in the Forest Service Land Status Records for the Okanogan-Wenatchee National Forest and through a restrictive covenant on private property owned by Holden Village. The institutional controls are anticipated to be needed in perpetuity, since hazardous substances will be left on the Site. The institutional controls would:

    1. Notify the public of contaminated areas that will be left on the Site, and prevent humans from direct contact with hazardous substances by warning of the risk;
    2. Protect the integrity of the remedy by preventing changes in site use that would reduce effectiveness of the remedy;
    3. Include a requirement for consultation with the Agencies prior to changes in land use to ensure the remedy remains protective;
    4. Require a soil management plan to address handling of soil with visible tailings that may be excavated in the future;
    5. Prevent potential future use of groundwater that exceeds human health risk-based criteria as a drinking water source, i.e., within WMAs;
    6. Provide for permanent access to privately owned land to monitor and maintain the remedy; and
    7. Implement possible administrative access restrictions to some portions of the Site.

- Long-term monitoring to assess remedy performance, ARAR compliance, and protectiveness.

12.2.6 Permits

CERCLA Section 121(e)(1) states that "no Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site where such remedial action is selected and carried out in compliance with [Section 121]." 42 U.S.C. § 9621(e)(1). The term "on-site" is clarified in the NCP at 40 C.F.R. § 300.5, which states that "on-site means the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action." The Agencies have determined that the Site includes the Railroad Creek valley from the Ballfield Area west of the Holden Mine to the area of contaminated Lake Chelan sediment at Lucerne. The Agencies will determine the substantive requirements that are to be met in lieu of permits that otherwise would be required for implementation of the remedy within this on-site area.

12.3 Summary of Estimated Remedy Costs

The Total Present Worth Cost of the Selected Remedy is approximately $107 million, as summarized in Table 23. The Agencies do not believe the changes made to Alternative 14 to create the Selected Remedy during the remedy selection process will significantly change the cost estimated in the ASFS.

The cost estimate presented in the ASFS is based on the best available information regarding the anticipated scope of the Selected Remedy. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost. Changes in the cost may arise as design is accomplished and/or as a result of new information that will be collected during the remedial design. Changes to the remedy will be documented in the form of a memorandum in the Administrative Record, an ESD, or a ROD Amendment.

12.4 Expected Outcome of the Selected Remedy

The expected outcome of the Selected Remedy is summarized below.

The tailings and waste rock caps will be regraded to achieve stability and capped and revegetated with native species to comply with ARARs and ensure environmental protectiveness.

Revegetation with native plant species will follow removal or capping of impacted soil in areas including the Lower West Area, and the Ventilator Portal Surface Water Retention Area and other areas disturbed by preparations for, or implementation of, the remedy. The goal of the revegetation is to restore native ecosystems appropriate for the Railroad Creek valley, as required under the Forest Plan and EPA guidance.[33]

The duration and effectiveness of *in situ* treatment cannot be predicted until completion of treatability studies, but the DSHH, affected portions of the Lower West Area and Wind-Blown Tailings area, and other similar areas will continue to support forest and wetlands, with reduced adverse impacts on terrestrial receptors. The Honeymoon Heights Waste Rock Piles will not be physically altered, but the adverse effects of hazardous substances will be remedied through *in situ* treatment.

The remedy will address the discharge of contaminated groundwater into Railroad Creek. This, along with eliminating the effects of ferricrete and stabilizing the tailings pile slopes, will enable Railroad Creek to once again support fish and other aquatic life. The beneficial effects of eliminating the discharge of groundwater containing hazardous substances will begin as soon as groundwater containment is completed.

The Selected Remedy will achieve RAOs. Together, the selected response actions are expected to contain and manage the sources of groundwater contamination and restore groundwater to meet MCLs at and beyond the boundaries of the WMAs and to meet levels protective of surface water beneficial uses prior to the groundwater-surface water interface (i.e., groundwater is expected to achieve cleanup levels protective of surface water before reaching that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates). These outcomes are expected to occur in a reasonable timeframe shortly after implementation,

[33] Herbicides may be used as appropriate to treat weed-infested staging, travel, and disturbed areas according to the Pacific Northwest Region Invasive Plant Program Environmental Impact Statement (EIS) (2003) and the Okanogan-Wenatchee National Forest Invasive Plant EIS when completed. All applicable standards and guidelines from the Pacific Northwest Region Invasive Plant Program EIS, and Okanogan-Wenatchee National Forest Best Management Practices and/or the Okanogan-Wenatchee National Forest Invasive Species EIS (when completed) will be used during herbicide treatments.

following completion of the groundwater containment barriers and other remedy components. The timing for completing *in situ* soil treatment will be determined based on treatability tests during remedial design and implementation. Implementation of the Selected Remedy will support the reasonably anticipated land, groundwater, and surface water uses at the Site, subject to the institutional controls (see Section 9.1.5).

12.5 National Historic Preservation Act

The National Historic Preservation Act (NHPA), 16 U.S.C. § 470 et seq., provides that federal agencies take into account the effect of proposed actions (undertakings) on areas included or eligible for inclusion in the National Register of Historic Places (National Register). 16 U.S.C. § 470f.

The National Register-eligible Holden Mine Historic District is defined by the following elements/features grouped by function and location:

- Holden Mine Underground Workings and Portals;
- Holden Mill and General Office/Shop Complex;
- Tailings and Waste Rock Piles;
- Honeymoon Heights Camp and Tram;
- Winston Family Camp/Town Site;
- Town site (Holden Village);
- Miscellaneous features and scattered debris in the area between the Holden Ball Field, Honeymoon Heights Camp, Holden Village Town site, Holden Mill, and Tenmile Creek; and
- Forest Road 8301 between Lucerne and Holden Mine.

Individually and collectively these features/elements contribute to the significance of the Historic District.

Based on their review of the April 2011 Section 106 report titled "Holden Mine CERCLA Remediation Section 106 Consultation in Response to Alternatives 11, 13 and 14, Chelan Ranger District, Okanogan-Wenatchee National Forest, Chelan County, Washington" the Agencies and the Washington State Historic Preservation Officer (SHPO) have determined and concur that the Selected Remedy will have an adverse effect on the Holden Mine Historic District because National Register-eligible historic mining features/elements will be removed or demolished and the landscape of the mine will be altered. Groups of affected historic features/elements are as follows:

1. Tailings Piles 1, 2, and 3, and the West and East Waste Rock Piles adjacent to the mill;

2. Holden Mill, office complex, and A-frame garage located in the Maintenance Yard below the Holden Mill;

3. Miscellaneous mining features and debris/artifacts located in the Lower West Area, Ballfield Area, Holden Village, and in the Wind-Blown Tailings Area east of Tailings Pile 3; and

4. The abandoned Holden septic system north of Railroad Creek and Forest Service Site 02-27.

The area of greatest impact will be south of Railroad Creek. The Selected Remedy will affect tailings, all or some of the waste rock piles, the Holden Mill and its associated office/shop complex, and the Maintenance Yard below the mill. Virtually all physical manifestations of the mine, with the exception of Honeymoon Heights Camp and the Honeymoon Heights tram, will be removed or capped creating an altogether different landscape south of the creek. The visual appearance of the Wind-Blown Tailings Area north of Railroad Creek will likely be changed as well. Portions of the abandoned Holden septic system (part of the Historic District) and the scarred trees documented as Site 02-27 will likely be removed by relocation of Railroad Creek or by treatment of wind-blown tailings in the same area.

Currently, the following groups of components of the Holden Mine Historic District will not be physically impacted:

1. Honeymoon Heights, Winston, and Holden camp/town sites; and

2. Forest Service sites 02-130 (Holden Guard Station) and 02-131 (45CH820) (Winston Peeled Cedars) located within the boundary of the Holden Mine Historic District will be avoided.

Forest Service Site 06170200027 is also located within the boundary of the Historic District, but as the site is not eligible for the National Register, it need not be avoided.

Substantively the NHPA regulations provide that an undertaking will evaluate and include "ways to avoid, minimize, or mitigate adverse effects" 36 C.F.R. § 800.6(b).

Appendix A of Part 2 of this ROD includes the Selected Remedy measures to avoid, minimize, or mitigate adverse effects to National Register-eligible sites located within the Selected Remedy area of potential effect.

13.0 STATUTORY DETERMINATIONS

13.1 Protection of Human Health and the Environment

The Selected Remedy will protect human health using engineering controls (consolidation and capping) for impacted soil that exceeds human health-based criteria for direct contact and ingestion in the Lower West Area, Lagoon Area, and Maintenance Yard, and institutional controls for waste rock and impacted soil on Honeymoon Heights.

The Selected Remedy will protect human health from exposure to contaminated groundwater by ensuring groundwater at and beyond the edge of the WMA meets drinking water standards and by institutional controls that prevent using groundwater contained within the WMA as drinking water.

The Selected Remedy will protect terrestrial environmental receptors from soil that exceeds cleanup levels through a combination of engineering controls (consolidation and capping) and *in situ* treatment. The Selected Remedy will protect aquatic environmental receptors through a combination of engineering controls, including containment, collection, and treatment of impacted groundwater that will otherwise discharge into Railroad Creek; stabilization of the tailings pile slopes and protection from erosion and scour; and by eliminating ferricrete from aquatic habitat. Monitoring will follow source controls to confirm that risks are low and decrease over time.

Consistent with the RAOs, opportunities will be sought during the implementation of the remedy to reduce its environmental footprint as defined in U.S. EPA Office of Solid Waste and Emergency Response Principles for Greener Cleanups and EPA Region 10's August 2009 Clean and Green Policy.

13.2 Compliance with Applicable or Relevant and Appropriate Requirements

The Selected Remedy for the Site will comply with federal and state ARARs that have been identified. The Selected Remedy will contain soil and groundwater exceeding cleanup levels within WMAs on the Site. Groundwater within the WMAs on the Site will not be returned to beneficial use; however, groundwater and surface water at and beyond the boundaries of the WMAs will be restored to beneficial use and achieve ARARs under the Selected Remedy. Tables 16 through 19 provide a complete list of ARARs and TBCs that must be addressed by the Selected Remedy and a comparison of how Alternatives 11M, 13M, and 14 would address each of these ARARs.

13.3 Cost-Effectiveness

In the Agencies' judgment, the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." 40 C.F.R. § 300.430(f)(1)(ii)(D). This was accomplished by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment, and ARAR-compliant), as well as comparison to Alternative 13M that did not satisfy the threshold criteria.

The Selected Remedy is, overall, more cost-effective than any of the other alternatives considered since it provides better long-term effectiveness and permanence, along with a greater degree of certainty that it will be successful.

As discussed in Section 10.3, the Selected Remedy (based on Alternative 14) has less risk remaining from the untreated waste or treatment residuals remaining at the conclusion of the remedial activities since it includes treatment of soil that is not treated under Alternative 13M and provides for a greater degree of groundwater containment, collection, and treatment.

The Selected Remedy is less costly than Alternative 11M, but provides substantially the same degree of environmental risk reduction. Although removal of waste rock and impacted soil from Honeymoon Heights would produce more certain benefits than *in situ* treatment, this benefit would be gained at the cost of substantially greater adverse environmental impacts compared to the Selected Remedy.

The Selected Remedy also is more reliable than Alternative 11M, since it does not rely on the membrane liner system used in the Alternative 11M tailings and waste rock pile caps that would be difficult to maintain and repair.

The alternatives evaluated have similar uncertainties associated with: a) land disposal of treatment system residuals: b) the potential need to replace technical components of the remedy (except the geomembrane liner referred to above); and c) potential risk if components of the remedy need replacement. As discussed in the ASFS, there will be a similarly low risk to human health and the environment, compared with existing conditions, should remedy components fail or need to be replaced under Alternatives 11M, and 13M, and the Selected Remedy.

Overall cost-effectiveness also includes the degree to which the Selected Remedy employs treatment to reduce toxicity, mobility, or volume compared to other alternatives. Alternatives 11M, 13M, and 14 use similar treatment technology to remove hazardous substances from groundwater and immobilize these substances in sludge contained in an on-site landfill, following treatment of intercepted groundwater. The Selected Remedy, similar to Alternative 11M, will prevent migration of hazardous substances in groundwater from all known source areas. Alternative 13M would not prevent migration of hazardous substances in groundwater under Tailings Piles 2 and 3 and contaminated groundwater would continue to discharge to Railroad Creek.

Overall cost-effectiveness also includes the short-term effectiveness of the Selected Remedy Evaluation. As discussed in Section 10.1.2, the Selected Remedy has similar short-term risks to the community, potential impacts to workers during remedial construction, and environmental impacts of the remedial action compared to the other alternatives. The main difference is that construction of the Selected Remedy will take longer and involve more construction compared to Alternative 13M. However, this is because Alternative 13M would not be as protective of the environment as the Selected Remedy, and the Selected Remedy will achieve protection more rapidly than Alternative 13M.

Because the Selected Remedy will be accomplished in two phases, it will take longer to complete than Alternative 11M. However, neglecting the 5-year break between the first and second phases of construction, the Selected Remedy is expected to require less actual construction time compared to Alternative 11M because of the elimination of the geomembrane and removal actions on Honeymoon Heights.

13.4 Use of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

The Agencies have determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at the Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the Agencies have determined that the Selected Remedy provides the best balance of tradeoffs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal, and considering state and community acceptance.

The NCP balancing criteria in selecting a remedy include: 1) long-term effectiveness and permanence; 2) reduction of toxicity, mobility, or volume through treatment; 3) short-term effectiveness; 4) implementability; and 5) cost. The Selected Remedy achieves these criteria as summarized below, and as more fully discussed in Section 10.1.2 of this ROD.

Engineering controls employed in the Selected Remedy, including removal and containment, are appropriate as a permanent remedy for soil at the Site because this soil can be reliably controlled in place.

The Selected Remedy achieves the statutory preference for long-term reduction of toxicity and mobility of hazardous substances with treatment as a principal element.

The Selected Remedy includes containment, collection, and treatment of groundwater above cleanup levels (using pH adjustment and precipitation to remove hazardous substances) that would otherwise discharge into surface water. This is an established form of engineering controls that has been demonstrated at a number of other sites (as described in the final Feasibility Study). Capping the tailings piles and the main waste rock piles, and containment, collection, and treatment of impacted groundwater are the most permanent solutions that are practicable at the Site.

In situ treatment, while less proven than consolidation and capping, can be accomplished with less adverse environmental impact and, therefore, is identified for some areas of the Site, including the small waste rock piles on Honeymoon Heights and other specified areas where impacted soil will be left in place. This treatment, using pH adjustment to reduce the mobility and toxicity of hazardous substances, is also a permanent solution for those specific areas of the Site.

The Selected Remedy's engineering controls provide for long-term effectiveness and permanence, achieve short-term effectiveness, and are implementable.

As described in Section 12, the overall effectiveness of the Selected Remedy was determined to be proportional to its costs and, hence, the Selected Remedy is cost-effective.

13.5 Preference for Treatment as a Principal Element[34]

The Selected Remedy includes treatment of both groundwater and some impacted soil, which satisfies the statutory preference for treatment.

The NCP also established an expectation for use of engineering controls such as containment for waste that poses a relatively low, long-term threat or where treatment is impracticable (40 C.F.R. 300.430(a)(1)(iii)(B)). Engineering controls, including consolidation and containment (capping), are employed for most soil in the Selected Remedy.

The Selected Remedy fully addresses the statutory preference for permanence and treatment to the maximum extent practicable.

13.6 Five-Year Review Requirements

Because the Selected Remedy will result in hazardous substances remaining on the Site above levels that allow for unlimited use and unrestricted exposure, statutory reviews will be conducted at least every 5 years after initiation of the remedial action to ensure that the Selected Remedy is, or will be, protective of human health and the environment.

---

[34] The NCP establishes an expectation for the use of treatment to address the principal threats posed by a site wherever practicable [40 C.F.R. 300.430(a)(1)(iii)(A)]; however, no Principal Threat Wastes were identified on Site.

14.0 DOCUMENTATION OF SIGNIFICANT CHANGES FROM THE PREFERRED ALTERNATIVE IN THE PROPOSED PLAN

The Proposed Plan was released for public comment on June 23, 2010. The Proposed Plan identified Alternative 14 as the Preferred Alternative. The Agencies reviewed the written and verbal comments submitted during the public comment period, and determined that no significant changes to the remedy, as originally identified in the Proposed Plan, are necessary or appropriate. The Selected Remedy contains minor changes from the Preferred Alternative identified in the Proposed Plan, as summarized below. Modification of the Preferred Alternative to create the Selected Remedy in response to comments is, consistent with the NCP [40 C.F.R. § 300.430(f)(4)(i)].

1. Final selection of the number and location of groundwater treatment facilities will be determined during remedial design, based on the results of approved engineering studies. The final Feasibility Study included evaluation of two separate groundwater treatment facilities (i.e., in the Lagoon Area, and south of Railroad Creek and east of Tailings Pile 3) that could be operated independently or in series (i.e., with one location providing pretreatment for a portion of the groundwater); as well as a single treatment facility located northeast of Tailings Pile 3. The final Feasibility Study indicated there are a number of tradeoffs with different treatment system configurations that will need to be evaluated during remedial design.

2. Final design of tailings and waste rock pile slopes, including a stabilizing buttress or ground improvement, and the extent of creek relocation will be determined during remedial design, based on the results of approved engineering studies. Ferricrete removal will be required where present in reaches of the creek that are not relocated.

3. Remediation of impacted soil in the Ventilator Portal Surface Water Retention Area, Lower West Area, and the Maintenance Yard, involving either capping in place, *in situ* treatment, and/or consolidating the impacted soil into the tailings piles before capping, or some combination of these approaches, will be determined during remedial design, based on the results of approved engineering studies.

4. Although ARAR waivers were discussed in the Proposed Plan for groundwater quality within the WMAs, the Agencies have determined for this ROD that waivers are not required.

5. Surface water cleanup levels were modified slightly from those presented in the Proposed Plan. These modifications represent changes in background water quality and hardness values that reflect additional data collected by Intalco since the Proposed Plan.

6. Additional evaluations of terrestrial ecological risks were conducted for several AOIs; these evaluations were prompted by comments received on the Proposed Plan. The additional evaluations looked at tissue concentrations (plants and invertebrates) in relation to tissue-based toxicity values and tissue concentrations in background areas. They also looked at soil pH and its effect on the toxicity of aluminum. As a result, some constituents were eliminated as contaminants of concern for the terrestrial ecological pathway. At the Wind-blown Tailings Area, the contaminants of concern previously identified in the Proposed Plan were eliminated, resulting in a change in the Selected Remedy compared to the Preferred Alternative for this AOI from *in situ* soil treatment to no action except where visible tailings are encountered during remedy construction and/or in the event of future changes in land use or ground disturbance.

7. The Selected Remedy also differs from the Preferred Alternative for the Ballfield Area. The remedy was changed from *in situ* soil treatment, as presented in the Proposed Plan, to a combination of hot spot investigation/removal along with possible *in situ* treatment. This modification resulted from the additional ecological risk evaluations described above in Item 6 along with further evaluation of the spatial distribution of contaminants and historical data (i.e., the possible presence of an old haul road).

8. The Proposed Plan called for consolidation of tailings encountered during construction in areas outside the main tailings piles, including within the Wind-blown Tailings Area and in the Lower West Area, and consolidation of these materials on the tailings piles. The Selected Remedy presented in this ROD also calls for tailings encountered in the wetlands directly east of Tailings Pile 3 to be removed and consolidated. This change reflects the observation of tailings in the wetlands during early action construction activities and the possibility that such tailings may not be otherwise be removed during construction of the water treatment plant, since the location of the treatment plant may not be in this area (as was envisioned in the Proposed Plan).

9. The WMA boundaries for the Selected Remedy were redrawn from those shown in the Proposed Plan to combine several adjacent areas. These changes were made to more accurately reflect the indistinguishable impacts from these adjacent areas on underlying groundwater quality.

10. The ROD includes a requirement for future sediment monitoring using bioassays, based on scientific information that was not available at the time of the Proposed Plan (Ecology 2011).

11. The point of compliance discussion was further clarified with respect to groundwater MCLs and surface water cleanup standards (groundwater to surface water discharge).

15.0 REFERENCES

Boulton et al. 1998. The Functional Significance of the Hyporheic Zone in Streams and Rivers. Annual Review of Ecology and Systematics. 1998.

Cubbage, J., D. Batts, and J. Breidenbach 1997. Creation and Analysis of Freshwater Sediment Quality Values in Washington State, Washington State Department of Ecology Publication No. 97-323A.

Dames and Moore 1999. Draft Final Remediation Investigation Report, Holden Mine Site. July 28, 1999. Prepared for Alumet, Inc.

Ecology 2007. Model Toxics Control Act - Cleanup (Chapter 173-340 WAC). Revised November 2007.

Ecology 1997. Effects of Holden Mine on the Water, Sediments, and Benthic Invertebrates of Railroad Creek (Lake Chelan). Washington State Department of Ecology. Publication No. 97-330. July 1997.

Ecology 2008a. Water Quality Program Permit Writer's Manual. Publication No. 92-109.

Ecology 2008b. Water Quality Program Criteria for Sewage Works Design. Publication No. 98-37.

Ecology 2010. Water Quality Program Permit Writer's Manual. Publication No. 92-109. Revised November 2010.

Ecology 2011. Development of Benthic SQVs for Freshwater Sediments in Washington, Oregon, and Idaho. Washington State Department of Ecology Publication No. 11-09-05. Dated November 2011.

EPA 2000. EPA Guidance: A Guide to Developing and Documenting Cost Estimates during the Feasibility Study. July 2000.

EPA 2004a. An Examination of EPA Risk Assessment Principles and Practices. EPA/100/B-04/001. March 2004.

EPA 2004b. Region 9 Preliminary Goals Table. October 2004.

EPA 2009. Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration. OSWER Directive 9283.1-33, dated June 26, 2009.

ERM 2008. TEE Field Investigation Data Report, Holden Mine Site, Chelan County, Washington. November 12, 2008.

ERM 2009a. Draft Terrestrial Ecological Evaluation Report, Holden Mine Site, Chelan County, Washington. March 2009. Prepared for Intalco.

ERM 2009b. Draft Proposed Alternative Toxicity Reference Values for Copper, Thallium and Aluminum, in Support of the Terrestrial Ecological Evaluations, Holden Mine Site, Chelan County, Washington. Prepared for Intalco. September 2009.

ERM 2009c. Draft Proposed Alternative Toxicity Reference Values for Lead, Mercury, Molybdenum, and Zinc in Support of the Terrestrial Ecological Evaluations, Holden Mine Site, Chelan County, Washington. Prepared for Intalco. November 2009.

ERM 2010a. Terrestrial Ecological Evaluations Summary, Holden Mine Site, Chelan County, Washington. January 2010.

ERM 2010b. Draft Tailings and Waste Rock Pile Cover Evaluation and Selection, Holden Mine Site, Chelan County, Washington. January 2010.

ERM and URS 2009. Draft Alternative 13M Evaluation Report, Holden Mine Site, Chelan County, Washington. August 14, 2009.

Forest Service 1940. Forest Surface Road Resurfacing Memo. W.O. Shambaugh, District Ranger. Prepared for Howe Sound Company. April 24, 1940.

Forest Service 1999. Holden Mine Remedial Action Objectives. Norman F. Day, Forest Service. Prepared for David E. Jackson & Associates, Inc. February 26, 1999.

Forest Service 2000. Agencies' Detailed Comments on the Holden Mine Draft Remedial Investigation Report dated July 29, 1999. February 1, 2000. Norman F. Day, Forest Service. Prepared for David E. Jackson & Associates, Inc.

Forest Service 2002a. Finalization of Holden Mine Remedial Investigation Report. Norman F. Day, Forest Service. Prepared for David E. Jackson & Associates, Inc. February 8, 2002.

Forest Service 2002b. Agencies' Detailed Comments on the Holden Mine Draft Feasibility Study dated June 12, 2002. Norman F. Day, Forest Service. Prepared for David E. Jackson & Associates, Inc. July 26, 2002.

Forest Service 2003. Comments on Intalco's Response to Agency Comments Regarding ARARs, dated January 22, 2003. March 6, 2003. Norman F. Day, Forest Service. Prepared for David E. Jackson & Associates, Inc.

Forest Service 2007a. Agencies' Comments on the Draft Final Feasibility Study. August 31, 2007. Prepared for Intalco.

Forest Service 2007b. Supplemental Feasibility Study, Holden Mine Site, Chelan County, Washington. September 2007.

Forest Service 2007c. Agencies' Comments on Intalco's Alternative 9 Description. Prepared for Intalco. August 31, 2007.

Forest Service 2007d. RE: Completion of the Feasibility Study for the Holden Mine Site. Prepared for Theodore L. Garrett, Covington & Burling, Counsel to Alumet (Intalco). September 13, 2007.

Forest Service 2010a. Addendum to the Supplemental Feasibility Study, Holden Mine Site, Chelan County, Washington. June 1, 2010.

Forest Service 2010b. Agencies' Comments on Intalco's August 14, 2009, Alternative 13M Evaluation Report. June 1, 2010.

Forest Service 2010c. Proposed Plan, Holden Mine Site, Chelan County, Washington. June 1, 2010.

Garrett, Theodore L. 2005. Holden Mine Remedial Alternative 9, Alternative 9 Description and Focused CERCLA-MTCA Feasibility Evaluation, Holden Mine Site, Chelan County, Washington. Covington & Burling, Counsel to Alumet (Covington and Burling). November 18, 2005.

Garrett, Theodore L. 2007. RE: Holden Mine: Submission of Alternative 13. Covington & Burling, Counsel to Alumet (Covington and Burling). October 15, 2007.

Gensemer, R.W. and R.C. Playle 1999. The Bioavailability and Toxicity of Aluminum in Aquatic Environments. Critical Reviews in Environmental Science and Technology, 29(4), 315-450, 1999.

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, New York.

Hart Crowser 2005. Holden Mine Site, Chelan County, Washington, Site Information Package. Prepared for USEPA National Remedy Review Board. September 1, 2005.

Ingersoll et al. 1996. Calculation and Evaluation of Sediment Effect Concentration for the Amphipod Hyalella azteca and the Midge Chironomus riparius. Journal of Great Lakes Research. 22(3):602-623.

Lappivaara et al. 1999. A Bioaccumulation and Subchronic Physiological Effects of Waterborne Iron Overload on Whitefish Exposed in Humic and Nonhumic Water. Archives of Environmental Contamination and Toxicology. 37: 196-204.

Michelsen, T. 2003. Development of Freshwater Sediment Quality Values for Use in Washington State. Phase II Report: Development and Recommendation of SQVs for Freshwater Sediments in Washington State. Avocet Consulting. September 2003.

Pacific Northwest Laboratory 1992. Draft Holden Mine Reclamation Project - Final Report. Contract DE-AC06-76RLO 1830.

Persaud et al. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of Environment and Energy. ISBM 0-7729-9248-7.

Steffen, Robertson, and Kirsten, Inc. (SRK) 2003. Results of Humidity Cell Testing on Tailings – Holden Mine. Steffen, Robertson, and Kirsten (Canada), Inc. July 2003.

Stratus 2005. HEA Calculations for the Holden Mine Site, Chelan County, North Central Washington State. Prepared for Forest Service. April 15, 2005.

URS 2001a. Holden Mine November 2000 Underground Investigation Data Transmittal. Jennifer Deters, URS. Prepared for Norman Day, Forest Service. January 24, 2001.

URS 2001b. Holden Mine Spring 2001 Underground Investigation Data Transmittal. Jennifer Deters, URS. Prepared for Norman Day, Forest Service. August 28, 2001.

URS 2002a. Holden Mine Fall 2001 Hydrogeologic Investigation Project Plans, Response to Agency Comments. Jennifer Deters, URS. Prepared for Norman Day, Forest Service. November 6, 2001.

URS 2002b. Fall 2001 Geotechnical/Geochemical Investigation Data Transmittal, Holden Mine RI/FS. URS Corporation. April 1, 2002.

URS 2002c. Fall 2001 Lake Chelan Sediment Sampling Data Transmittal, Holden Mine RI/FS. URS Corporation. April 1, 2002.

URS 2002d. Draft Feasibility Study, Holden Mine Site. Prepared by URS Corporation for Intalco. June 12, 2002.

URS 2002e. Spring 2002 Hydrogeologic Investigation Data Transmittal Holden Mine RI/FS. Jennifer Deters, URS. Prepared for Norman Day, Forest Service. September 16, 2002.

URS 2002f. Summer 2002 Groundwater Level Data Transmittal Downgradient Groundwater Monitoring Wells, Holden Mine RI/FS. URS Corporation.

URS 2003a. Final Monitoring Report, Bat Monitoring and Winter Survey of Underground Mine Workings, Holden Mine RI/FS. URS Corporation. February 11, 2003.

URS 2003b. Fall 2002 Hydrogeologic Investigation Data Transmittal, Holden Mine RI/FS. URS Corporation. February 5, 2003.

URS 2003c. Fall 2002 Lake Chelan Sediment Sampling Data Transmittal, Holden Mine RI/FS. URS Corporation. May 5, 2003.

URS 2003d. Spring 2003 Surface Water Monitoring Data Transmittal, Holden Mine RI/FS. URS Corporation. October 23, 2003.

URS 2004. Draft Final Feasibility Study, Holden Mine Site. URS Corporation. February 19, 2004.

URS 2005. Alternative 9 Description and Focused CERCLA-MTCA Feasibility Evaluation, Holden Mine Site, Chelan County, Washington. URS Corporation. Prepared for Intalco Aluminum Co. November 17, 2005.

URS 2006. Holden Mine, Spring 2006 Field Effort, Data Transmittal. URS Corporation. Prepared for Intalco. December 22, 2006.

URS 2008. Holden Mine 2008 Field Investigation Data Compilation Report. November 7, 2008. URS Corporation.

URS 2009a. Appendix F: Draft Supplemental Human Health Risk Evaluation for the Tailings and Waste Rock Piles. URS Corporation. July 10, 2009.

URS 2009b. Fall 2009 Additional Sampling Recommendations. URS Corporation. October 13, 2009.

URS 2010. Draft Hydrogeology Technical Memorandum Addendum in Context of a Contingent Remedy Holden Mine Site. URS Corporation. February 24, 2010.

USACE et al. 2006. Sediment Evaluation Framework for the Pacific Northwest - Interim Final. Prepared by the US Army Corps of Engineers - Seattle District, Portland District, Walla Walla District, and Northwestern Division; Environmental Protection Agency Region 10; Washington State Department of Ecology; Washington Department of Natural Resources; Oregon Department of

Environmental Quality; Idaho Department of Environmental Quality; National Marine Fisheries Service; and US Fish and Wildlife Service 2006. September 2006.

USDA Office of General Counsel (USDA OGC) 2006. Holden Mine, Iron and Aluminum as Hazardous Substances. Prepared by James Alexander for Intalco. April 7, 2006.

USDA Office of General Counsel (USDA OGC) 2008. Holden Mine - Modification of AOC Work and Proposed Plan Deferral. Prepared by James Alexander for Intalco. March 11, 2008.

USFWS 2004. Tables of Published Toxicity Values at Water Hardness Concentrations Similar to Railroad Creek. June 16, 2004.

USFWS 2005. Aluminum and Iron Toxicity Related to Water Quality Parameters Similar to Railroad Creek. January 3, 2005.

USFWS 2007a. Response to Intalco's June 17, 2005, Comments on Potential for Impacts to Aquatic Life in Railroad Creek from Copper, Cadmium, Zinc, Aluminum, and Iron, Final Agency Response. James A. Hansen, PhD. Prepared for Holden Mine Remedial Action Agencies. August 27, 2007.

USFWS 2009. Additional Request for Information (USFS No: 2160/2800). Ken S. Berg, Washington Fish and Wildlife Office. Prepared for Norman Day, US Forest Service. July 15, 2009.

USGS 2011. USGS Surface-Water Data for Washington. Gage #12451500 Railroad Creek at Lucerne, Washington. http://waterdata.usgs.gov/wa/nwis/sw. Data accessed March 21, 2011.

Wilkin, Richard T. 2007. Metal Attenuation Processes at Mining Sites. Groundwater and Ecosystem Restoration Division of the National Risk Management Research Lab. Published by EPA. September 2007.

L:\Jobs\476916\ROD\Holden ROD Final January 2012.doc

Table 1 - Summary Statistics for Groundwater, Surface Water, and Soil

Sample Collection Season/Area	Constituents of Concern (COCs)	Minimum Concentration in µg/L	Maximum Concentration in µg/L	Mean Concentration in µg/L	95 UCL Concentration in µg/L
Groundwater Spring Conditions	Aluminum	20.0 U	2,010,000	18,679	74,800
	Cadmium	0.200	5,120	40.0	180
	Copper	0.500	19,000	1,250	2,250
	Iron	20.0	1,690,000	76,700	174,000
	Lead	0.010	280	13.1	24.0
	Zinc	4.00 U	1,530,000	8,900.00	49,200
Groundwater Fall Conditions	Aluminum	20.0 U	82,500	3,690	11,100
	Cadmium	0.04 U	63.0	5.27	12.80
	Copper	0.50 U	7,560	353	1,070
	Iron	20.0	1,690,000	106,000	160,000
	Lead	1.00	104	6.22	9.70
	Zinc	4.00	8,960	979	2,170
Surface Water Spring Conditions	Aluminum	3.80	260	146	185
	Cadmium	0.040 U	2.57	0.36	0.475
	Copper	0.100	155	15.9	29.6
	Iron	10.0 U	2,300	382	573
	Lead	0.011	0.600	0.34	0.230
	Zinc	0.400 U	372	53.3	85.5
Surface Water Fall Conditions	Aluminum	19.0	120	61.9	77.9
	Cadmium	0.010 U	0.140	0.0853	0.104
	Copper	0.300	3.90	1.44	1.87
	Iron	10.0 U	1,970	489	865
	Lead	0.040	0.400	0.230	0.240
	Zinc	4.00 U	30.0	16.6	22.1
Soil in Areas of Concern (AOCs)	Aluminum	1,240	33,500	14,700	15,300
	Arsenic	0.300	60.0	8.06	10.4
	Barium	16.6	854	204	253
	Cadmium	0.200	184	8.36	20.5
	Chromium	3.20	120	19.7	24.0
	Copper	6.60	24,100	1,190	2,760
	Lead	2.00	1,930	96.1	160
	Mercury	0.030 U	5.00	0.353	0.464
	Molybdenum	0.50	74.0	11.6	15.10
	Selenium	0.20 U	12.0	2.79	3.87
	Silver	0.30	27.0	2.09	2.48
	Thallium	0.09 U	3.00	0.533	0.506
	Zinc	8.00 U	23,700	674	1,390

General Notes:

1. Soil data from TEE, Appendix A (ERM 2009)
2. Water data from URS database query 9/01/09 for stations RC-2, RC-3, RC-4, RC-5, CC-01, and CC-2
3. In surface water and groundwater aluminum and iron are total concentration, all other concentrations are dissolved
4. All statistics calculated using EPA's ProUCL version 4.0
5. 95 UCL = The calculated 95 percent upper confidence level on the COC mean concentration
6. For data sets containing non-detects, the mean concentration was calculated using one-half non-detected value
7. µg/L - Micrograms per liter
8. mg/kg - Milligrams per kilogram
9. U = Contaminant not detected at the detection limit shown

Table 2 - Chemical-Specific ARARs for Drinking Water

Contaminants of Concern (a)	Federal MCLGs (b)	Federal MCLs (c)	State MCLs (d)	MTCA Method A (e)	MTCA Method B (f)
Aluminum	--	--	--	--	16,000 (g)
Cadmium	5.00	5.00	5.00	5.00	8.00
Copper	1,300	1,300	1,300	--	592
Iron	--	--	--	--	--
Lead	zero	15.0	15.0	15.0	--
Zinc	--	--	--	--	4,800

Notes:
(a) Concentrations in ug/L.

(b) Maximum Contaminant Level Goals (MCLGs) for non-carcinogens. Non-zero MCLGs are relevant and appropriate. 40 CFR 141.50 and 141.51 and Drinking Water Standards and Health Advisories, Office of Water, US EPA, EPA 822-B-00-001, Summer 2000.

(c) Maximum Contaminant Levels (MCLs). 40 CFR 141.62 and Drinking Water Standards and Health Advisories, Office of Water, US EPA, EPA 822-B-00-001, Summer 2000.

(d) WAC 246-290-310. State of Washington Primary MCLs.

(e) WAC 173-340-900, Table 720-1. MTCA Method A.

(f) WAC 173-340-720. MTCA Method B Groundwater cleanup levels. For carcinogenic constituents, the value presented is the lower of the non-carcinogenic and carcinogenic level calculated using Equations 720-1 and 720-2. Information from CLARC 3.1 was used unless otherwise noted.

(g) Calculated using reference dose (RfD) from EPA Region 9 Preliminary Remediation Goals table, EPA 2004b.

General Notes:

1. Sufficient data are not available to calculate groundwater background.
2. Shaded cells identify lowest chemical-specific ARAR. These ARARs are the RBCs used to identify COCs in Table 4 and are the cleanup levels shown in Table 11.
3. -- Not established or not applicable.

Table 3 - Chemical-Specific ARARs and Background Concentrations for Surface Water

Contaminants of Concern	Water Quality Standards For Surface Waters of The State of Washington WAC 173-201A		Section 304 of the Clean Water Act National Recommended Water Quality Criteria (EPA 2006)				National Toxics Rule 40 CFR 131.36(b)(1)				State of Washington Model Toxics Control Act Method B Cleanup Levels WAC 173-340-730	Maximum Contaminant Levels (b)	Background Concentrations (a)
	Protection of Aquatic Organisms		Protection of Aquatic Organisms		Protection of Human Health		Protection of Aquatic Organisms		Protection of Human Health		Protection of Human Health	Protection of Human Health	
	Acute	Chronic	Acute	Chronic	Consumption of Water and Organism	Consumption of Organism Only	Acute	Chronic	Consumption of Water and Organism	Consumption of Organism Only	Fish Ingestion	Drinking Water	
Aluminum	--	--	750	87	--	--	--	--	--	--	--	--	142
Cadmium	0.271	0.173	0.193	0.05	--	--	0.271	0.173	--	--	20.0	5.00	0.05
Copper	1.76	1.45	(c)	(c)	1,300	--	1.76	1.45	--	--	2,660	1,300	0.90
Iron			--	1,000	300 (d)	--	--	--	--	--	--	--	154
Lead	4.35	0.169	4.35	0.169		--	4.35	0.17	--	--	--	15.0	0.12
Zinc	14.9	13.6	15.2	15.4	7,400	26,000	14.9	13.6	--	--	16,500	--	9.8

Notes:

(a) Background values were determined using data from all samples collected at station RC-6 from April 1997 through June 2011. Following WAC 173-340-709(2), background was defined as the upper 90th percentile or four times the 50th percentile, whichever was lower.

(b) Values shown are lowest values of state or federal Maximum Contaminant Levels (MCLs) or non-zero MCL Goals from Table 2.

(c) The Aquatic Life Ambient Freshwater Quality Criteria—Copper 2007 Revision (EPA-822-R-07-001), was published in the Federal Register on February 22, 2007, but to date there are insufficient data to provide a basis for predicting acute and chronic copper concentrations for Railroad Creek. Cleanup level shown is set at background level. The Agencies anticipate that additional information may be available to modify the cleanup level based on monitoring during remedial design and/or following implementation of the remedy. When sufficient data are available, the cleanup level for copper may be modified using the Biotic Ligand Model through an Explanation of Significant Differences.

(d) This value based on secondary MCL (aesthetics). According to the SFS (Table 4, footnote [g]), surface water criteria based on secondary MCLs will not be enforced. Secondary MCLs are not used to develop cleanup levels.

General Notes

1. Values represent dissolved concentrations in ug/L for cadmium, copper, lead, zinc, and total concentrations in ug/L for aluminum and iron.

2. Underlined values require hardness correction specific to the sample data. The values presented in this table are based on a hardness of 9 mg/L CaCO3. This value represents 5th percentile of all sampling data from background station RC-6 (samples collected from April 1997 through June 2011), in accordance with the Water Quality Program Permit Writer's Manual, Ecology Publication Number 92-109, Revised July 2008.

3. Shaded cells identify lowest potential chemical-specific ARAR, *or* background concentration (if higher).

4. -- Not established or not applicable

5. The lowest ARAR for each constituent is the surface water RBC.

6. Surface water cleanup levels will be revisited periodically and as new data becomes available. Although cleanup actions at this site are exempt from administrative permit requirements, the substantive requirements of the National Pollutant Discharge Elimination System (NPDES) (33 USC § 1342, Section 402, and WAC 173-220) apply, including the concept of periodic review (e.g., every 5 years or more frequently). In addition, updates may occur as data are collected and evaluated from routine baseline and compliance monitoring, a possible Water Effects Ratio (WER) study, or the required Biotic Ligand Model (BLM) parameters. Changes to cleanup levels may be documented through an Explanation of Significant Differences (ESD) to the ROD.

Table 4 - Areas of the Site with Groundwater Concentrations That Exceed Drinking Water Criteria

Contaminants of Concern	Drinking Water Criteria (a) in ug/L	Ballfield Area		Honeymoon Heights Waste Rock Piles		Mine Portal		Lower West Area		East and West Waste Rock Piles (including Mill Building Area)		Tailings Pile 1		Tailings Pile 2		Tailings Pile 3		Wind-Blown Tailings Area		Downstream from Tailings Pile 3		Holden Village	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Aluminum	16,000	nd	nd	16,800	4,580	6,065	nd	5,140	1,290	6,890	1,790	61,600	43,500	804,000	3,960	17,300	6,760	nd	60.0	3,040	14,300	50.0	100
Cadmium	5.00	3.20	0.400	38.3	22.4	48.5	8.00	32.6	35.1	73.4	63.0	32.3	11.7	2,030	3.08	11.3	3.73	nd	nd	0.915	0.940	0.300	nd
Copper	592	10.0	nd	7,370	4,600	2,960	28.0	2,860	2,140	5,690	7,560	944	179	4,050	24.9	465	29.1	nd	1.00	24.9	64.2	3.00	3.20
Iron	--	nd	nd	130	480	202	nd	3,670	2,810	196	710	917,700	836,000	741,000	146,000	83,700	198,000	50.0	nd	781	16,700	330	80.0
Lead	15.0	nd	nd	7.25	8.92	28.2	1.00	7.11	8.00	8.27	13.0	3.07	nd	42.3	52.0	37.8	66.7	--	--	0.212	nd	nd	2.60
Zinc	4,800	30.0	11.0	4,800	2,530	8,840	2,980	4,720	4,900	9,270	8,960	4,940	5,500	510,000	294	823	278	18.0	34.0	131	167	77.3	10.0

Notes:

(a) Drinking water criteria presented in Table 2. These criteria are the human health RBCs and were used as the cleanup levels shown in Table 11.

General Notes:

1. Constituent concentrations in ug/L from Table 7 in the ASFS.
2. Shaded cells indicate exceedance of drinking water criteria (does not include exceedance of non-health-based secondary MCLs). Shaded cells also identify groundwater COCs for the protection of human health.
3. Arsenic and nickel are not included in this table although concentrations in groundwater were identified in the SFS as exceeding drinking water criteria in some areas of the Site. Updated statistical analyses (see Table 7 in the ASFS, footnote [d]) along with additional groundwater data collected through spring 2009, indicate that these constituents do not exceed drinking water standards.
4. -- Not analyzed or not applicable
5. nd = Non-detect.

Table 5 - Concentrations of Contaminants of Concern in Surface Water

Contaminants of Concern	Cleanup Levels in ug/L	Railroad Creek Upstream from Site RC-6		Railroad Creek Adjacent to Lower West Area-East RC-4		Copper Creek Diversion at Confluence with Railroad Creek CC-D1		Copper Creek at Confluence with Railroad Creek CC-2		Railroad Creek at Downstream Margin of Tailings Pile 3 RC-2		Railroad Creek Downstream from Site at Confluence of Tenmile Creek RC-5		Railroad Creek Mouth at Lake Chelan RC-3	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Aluminum	142	118	29.0	185	50.0	nd	--	153	30.0	190	96.0	246	120	198	70.0
Cadmium	0.050	0.041	0.0037	0.625	0.140	2.57	nd	nd	nd	0.381	0.130	0.580	0.120	0.206	0.100
Copper	1.45	0.950	0.430	34.4	3.90	155	nd	0.397	1.20	16.9	1.40	22.9	1.60	8.82	1.20
Iron	1,000	132	91	117	100	nd	--	84.6	50.0	720	1,180	2,300	1,440	471	440
Lead	0.169	0.142	0.500	0.365	0.400	0.200	nd	0.300	0.300	0.284	0.300	0.314	nd	0.252	0.200
Zinc	13.6	7.0	7.0	67.1	20.0	372	nd	13.0	nd	67.3	30.0	98.0	30.0	36.4	20.0

General Notes:

1. Values of aluminum and iron represent total concentrations in ug/L.

2. Values for cadmium, copper, lead, and zinc represent dissolved concentrations in ug/L.

3. Data to create this table obtained from URS database query on September 1, 2009.

4. Spring data represent samples collected in May, June, or July; fall data represent other nine months.

5. Consistent with the statistical approach for evaluating compliance with cleanup levels for groundwater presented in WAC 173-340-720(9), concentrations shown represent the upper one-sided 95 percent confidence limit (95 UCL) on the mean constituent concentration. In cases where the 95 UCL exceeds the maximum detected concentration, or where existing data are insufficient to calculate the 95 UCL, the maximum detected constituent concentration is shown. The 95 UCL was calculated using EPA's ProUCL statistical software package, version 4.00.04, using both censored and uncensored data. In order to obtain 95 percent coverage of the mean on some sample sets, ProUCL recommended percentile is greater than 95 percent due to high percentage of non-detects and/or high skewness of data distribution.

6. Data represent sampling rounds conducted from 1996 through spring of 2009; not all stations were sampled during each round and not all constituents were analyzed during each round.

7. Shaded cells indicate that value exceeds surface water cleanup levels identified in Tables 11 and 3.

8. nd = All sample results were non-detect.

9. -- Not analyzed

10. Sampling locations shown on Figure 13.

Table 6 - Concentrations of Contaminants of Concern in Sediment

Contaminants of Concern	Railroad Creek Sediment Sampling Locations																Range of Concentrations in Lucerne Bar Sediment
	355	356	367	RC-1	347	BKG 1/2	350	RC-2	345	DG-1	351	352	353	MP-7	354	RC-3	
Aluminum	86,000	87,000	78,000	10,400	83,000	11,300	34,000	8,540	78,000	9,380	89,000	75,000	88,000	13,300	76,000	7,890	9,400 to 19,000
Beryllium	1.0	1.0	1.0		1.0	0.08	nd		1.0	0.07	1.0	1.0	1.0		1.0		--
Cadmium	0.5	0.09	2.0	nd	2.0	0.9	nd	nd	0.6	1.1	0.06	0.5	nd	0.9	0.6	0.5	0.4 to 3.9
Chromium	79	36	97		85	17	18		70	4.4	44	93	52		74		--
Copper	74	12	37	29	240	77	200	101	140	184	26	130	13	147	150	59	46 to 308
Iron	63,000	47,000	99,000	15,700	71,000	17,000	150,000	19,000	50,000	20,600	66,000	71,000	40,000	26,300	60,000	14,800	15,400 to 52,800
Silver	nd	nd	nd		nd	0.64	1.2		0.17	0.73	0.067	0.11	0.45		0.01		--
Zinc	180	110	130	62	270	110	250	113	280	126	110	230	82	216	330	144	131 to 580

General Notes:
1. Concentrations in mg/kg are from Table 12 in SFS.
2. Shaded cells indicate concentrations exceed values shown in Table 11 of the Proposed Plan. These values are also RBCs.
3. -- indicates constituent was not analyzed in the sample.
4. nd = Non-detect

Table 7 - Bioassay Requirements

Bioassays must include a minimum of the following:

Bioassay Suite Selection

• Three endpoints
• Two species (*Hyalella azteca* and *Chironomus dilutus*, not Microtox*)
• One chronic endpoint (e.g., 20-28 day)
• One sub-lethal endpoint (e.g., growth)
• Selection of endpoints that is sensitive to metals toxicity. For example:
  o *Chironomus* 10-day Growth (Acute, Sub-Lethal)
  o *Chironomus* 20-day Mortality (Chronic, Lethal)
  o *Hyalella* 28-day Growth, (Chronic, Sub-Lethal)

*Microtox may not be used as one of the three required endpoints. However, it may be used in addition to these analyses.

Quality Assurance and Adverse Effects Levels for Biological Tests

Biological Test/Endpoint	Performance Standard		SQS	CSL
	Control	Reference		
Hyalella azteca				
10-day mortality	$M_C < 20\%$	$M_R < 25\%$	$M_T - M_C > 15\%$	$M_T - M_C > 25\%$
28-day mortality	$M_C < 20\%$	$M_R < 30\%$	$M_T - M_C > 10\%$	$M_T - M_C > 25\%$
28-day growth	$MIG_C \geq 0.15$ mg/individual	$MIG_R \geq 0.15$ mg/individual	$MIG_T/MIG_C < 0.75$	$MIG_T/MIG_C < 0.6$
Chironomus dilutus				
10-day mortality	$M_C < 30\%$	$M_R < 30\%$	$M_T - M_C > 20\%$	$M_T - M_C > 30\%$
10-day growth	$MIG_C \geq 0.48$ mg/individual	$RF/CF \geq 0.8$	$MIG_T/MIG_C < 0.8$	$MIG_T/MIG_C < 0.7$
20-day mortality	$M_C < 32\%$	$M_R < 35\%$	$M_T - M_C > 15\%$	$M_T - M_C > 25\%$
20-day growth	$MIG_C \geq 0.60$ mg/individual	$RF/CF \geq 0.8$	$MIG_T/MIG_C < 0.75$	$MIG_T/MIG_C < 0.6$

M = Mortality; C = Control; R = Reference; T = Test; F = Final; MIG = Mean Individual Growth at time final; mg = milligrams. An exceedance of the SQS and CSL requires statistical significance at $p = 0.05$. Bioassay procedures shall consider use of a control (instead of a reference samples). Comparison of test sediments to control is shown for SQS and CSL since it is rare to find appropriate reference sites. Any reference site must first be approved by the Agencies and reference results must meet the performance standards shown.

Sediment will be investigated using both bioassay and chemical analysis methods and must meet the most stringent cleanup criteria resulting from these methods. The use of numeric sediment quality guidelines (i.e., metals concentrations in sediment) developed from freshwater environments across the state are unlikely to accurately predict presence or absence of toxicity in sediment where water quality or provenance of sediment differs from those in the original data set used to develop the guidelines (e.g., See Ecology 2011). Bioassays are required to assess sediment quality where certain conditions are likely to modify availability of contaminants in sediment. For example, where one or more water chemistry parameters (e.g., pH, hardness, dissolved inorganics, dissolved nutrients) is outside the ranges seen in the initial data set or the sediment is partly composed of, or affected by, leachates and/or precipitates from mine tailings or drainage (see Ecology 2011). Details on post-remedy sediment performance monitoring procedures and requirements will be outlined in subsequent monitoring work plan(s). Future sediment monitoring will be conducted in accordance with best available science, and compared with updated regulations and guidance as they become available. Existing state freshwater citeria (Michelsen 2003), Sediment Management Standards (Chapter 173-204 WAC), and freshwater guidance are currently being updated. This approach provides a reasonable representation of chronic and acute exposure scenarios and lethal and sub-lethal endpoints. The first table (above) represents minimum requirements for selection of bioassay species and endpoints. The second table represents interpretive criteria that are equivalent to Sediment Quality Standard (SQS) and Cleanup Screening Level (CSL) effects level in Washington State Sediment Management Standards.

Table 8 - Concentrations of Contaminants of Concern in Soil

Contaminants of Concern	Tailings Piles 1, 2, & 3	East & West Waste Rock Piles	Honeymoon Heights Waste Rock Piles	Ballfield Area	Holden Village	Wind-Blown Tailings Area	Area Downslope from Honeymoon Heights	Lower West Area East	Lower West Area West	Lagoon	Maintenance Yard	Surface Water Retention Area
Aluminum	15,900	16,400	18,100	17,900	20,300	15,700	18,400	20,100	16,300	33,500	23,900	20,200
Arsenic	--	--	--	--	--	--	20.0	20.0	26.0	5.00	60.0	--
Barium	459	409	344	82.0	185	192	238	352	66.0	343	717	660
Cadmium	19.5	4.77	3.00	1.40	1.60	0.690	5.30	130	1.70	184	21.6	8.03
Chromium	14.7	56.9	17.0	26.0	32.0	18.0	21.0	24.0	26.0	21.0	33.0	26.9
Copper	865	1,350	1,450	72.0	260	118	1,680	6,230	80.0	24,100	3,160	1,980
Lead	65.1	224	1,910	16.0	52.0	37.0	77.0	644	13.0	746	1,070	141
Mercury	0.303	0.499	3.40	0.320	0.042	0.310	1.90	1.10	0.320	--	--	0.530
Molybdenum	20.0	17.0	22.0	2.30	2.90	19.0	17.0	53.0	2.20	74.0	16.0	21.1
Selenium	6.64	4.67	6.90	0.450	0.780	1.90	2.40	10.0	0.360	--	--	6.83
Silver	3.59	3.25	8.20	0.720	0.860	1.30	3.30	11.0	0.700	27.0	5.00	7.31
Thallium	0.810	0.631	1.50	nd	0.160	0.240	0.730	0.970	0.100	3.00	nd	1.20
Zinc	2,070	934	522	155	225	138	1,010	17,300	132	23,700	3,240	736
Gasoline-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	nd	1,200	--
Diesel-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	917	12,000	--
Heavy Oil-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	1,120	9,800	--

General Notes:

1. Concentrations in mg/kg.
2. -- Not analyzed
3. nd = All sample results were non-detect.
4. Data to create this table obtained from Appendix A of the draft TEE (ERM 2009a) except for petroleum hydrocarbon data for the Lagoon and Maintenance Yard, which is from a URS database query dated September 1, 2009.
5. Consistent with the statistical approach for evaluating compliance with cleanup levels for soil presented in WAC 173-340-740(7), concentrations shown represent the one-sided 95 percent upper confidence limit (95 UCL) on the mean constituent concentration. In cases where the 95 UCL exceeds the maximum detected concentration, or where existing data are insufficient to calculate the 95 UCL, the maximum detected constituent concentration is shown. The 95 UCL was calculated using EPA's ProUCL statistical software package, version 4.00.04, using both censored and uncensored data.
6. No soil data are available for the Former Mill Building area.
7. Shaded cells indicate concentrations exceed cleanup levels (See Table 11). Non-shaded cells indicate concentrations that do not exceed cleanup levels and/or analyte is not a constituent of concern for particular area.

Table 9 - Human Health-Based Chemical-Specific ARARs and Background Concentrations for Soil

Contaminants of Concern	Human Health-Based Levels				Site-Specific Background Concentrations (f)	
	MTCA Method A Soil Cleanup Levels (a)	MTCA Method B Soil Cleanup Levels				
		Soil Ingestion (b)	Soil Ingestion and Dermal Contact (b)	Groundwater Protection (c)	Mixed Conifer Background Area (BGMC)	Riparian Background Area (BGR)
Aluminum	--	--	--	--	18,200	17,600
Arsenic	20.0	0.670	0.620	0.034	4.80	16.0
Barium	--	5,600	5,000	925	164	133
Cadmium	2	80.0	74.0	0.69	3.30	1.80
Chromium (e)	2,000	120,000	110,000	2,000	24.0	38.0
Copper	--	2,960	2,700	260	45.0	110
Lead	250	--	--	3,000	14.0	25.0
Mercury	2	24.0	18.0	2.1	0.930	0.430
Molybdenum	--	400	360	--	8.80	2.90
Selenium	--	400	360	5.3	12.0	1.40
Silver	--	400	360	13.7	0.650	0.600
Thallium	--	5.60	5.00	1.6	0.360	0.130
Zinc	--	24,000	22,000	6,000	136	177
Gasoline-Range Hydrocarbons	30.0/100 (d)	--	--	30/100 (d)	--	--
Diesel-Range Hydrocarbons	2,000	--	--	2,000	--	--
Heavy Oil-Range Hydrocarbons	2,000	--	--	2,000	--	--

Notes:

(a) WAC 173-340-740(2), WAC 173-340-900 (Table 740-1). Model Toxics Control Act (MTCA) Method A.

(b) WAC 173-340-740(3). MTCA Method B unrestricted land use soil cleanup standards. The values presented are from Table 8 of the SFS and represent the lower of the non-carcinogenic and carcinogenic level calculated using Equations 740-1 and 740-2 for ingestion only and Equations 740-4 and 740-5 for ingestion and dermal contact.

(c) WAC 173-340-747 provides for the derivation of soil concentrations for groundwater protection that may be used to establish Method B soil cleanup levels. These values are from Table 8 of the SFS, except for gasoline-, diesel- and heavy oil-range hydrocarbons, which are from WAC 173-340-900, Table 740-1. As described in Section 2.4 of the SFS, these values would not form the basis of cleanup levels at the Site, in accordance with WAC 173-340-740(6)(f).

(d) 100 mg/kg is applicable when no benzene is present in soil and the total of BTEX is less than 1 percent of the gasoline mixture, otherwise 30 mg/kg is applicable.

(e) Regulatory values for chromium based on total or trivalent form. Background concentrations based on total chromium.

(f) Site-specific background soil concentrations from draft TEE. Riparian background (BGR) values are applicable to soils in Lower West Area (East & West), Lagoon, and Areas Downslope of Honeymoon Heights. Mixed conifer background (BGMC) values are applicable to all other areas.

General Notes:
1. Concentrations in mg/kg.
2. -- Not established or not applicable
3. Human health soil RBCs are primarily the Method B values for soil ingestion and dermal contact. The exceptions are lead and petroleum hydrocarbon compounds for which Method B levels are unavailable. For these constituents, the RBCs are the Method A values. The health-based soil CULs shown are the higher of the RBC and background.

Table 10 - Areas of the Site with Soil Concentrations That Exceed Human Health Criteria

Contaminants of Concern	Tailings Piles 1, 2, & 3	East & West Waste Rock Piles	Honeymoon Heights Waste Rock Piles	Ballfield Area	Holden Village	Wind-Blown Tailings Area	Area Downslope of Honeymoon Heights	Lower West Area--East	Lower West Area--West	Lagoon	Maintenance Yard	Surface Water Retention Area
Aluminum	15,900	16,400	18,100	17,900	20,300	15,700	18,400	20,100	16,300	33,500	23,900	20,234
Arsenic	--	--	--	--	--	--	**20.0**	**20.0**	**26.0**	5.00	**60.0**	--
Barium	459	409	344	82.0	185	192	238	352.0	66.0	343	717	660
Cadmium	**19.5**	**4.77**	3.00	1.40	1.60	0.690	**5.30**	**130**	1.70	**184**	**21.6**	**8.03**
Chromium	14.7	56.9	17.0	26.0	32.0	18.0	21.0	24.0	26.0	21.0	33.0	26.9
Copper	**865**	**1,350**	**1,450**	72.0	260	118	**1,680**	**6,230**	80.0	**24,100**	**3,160**	**1,980**
Lead	65.1	224	1,910	16.0	52.0	37.0	77.0	644	13.0	746	1,070	141
Mercury	0.303	0.499	**3.40**	0.320	0.042	0.310	1.90	1.10	0.320	--	--	0.530
Molybdenum	20.0	17.0	22.0	2.30	2.90	19.0	17.0	53.0	2.20	74.0	16.0	21.1
Selenium	6.64	4.67	6.90	0.450	0.780	1.90	2.40	**10.0**	0.360	--	--	6.83
Silver	3.59	3.25	8.20	0.720	0.860	1.30	3.30	11.0	0.700	**27.0**	5.00	7.31
Thallium	0.81	0.631	1.50	nd	0.160	0.240	0.730	0.970	0.100	**3.00**	nd	1.20
Zinc	2,070	934	522	155	225	138	1,010	**17,300**	132	**23,700**	3,240	736
Gasoline-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	nd	**1,200**	--
Diesel-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	917	**12,000**	--
Heavy Oil-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	1,120	**9,800**	--

General Notes:

1. Constituent concentrations in mg/kg from Table 10 in the ASFS.

2. In most cases, shaded cells indicate that value exceeds site-specific background concentration and human health-based soil criteria for the direct contact and/or ingestion pathway (Method B) (i.e., the health-based soil cleanup levels shown in Table 9). The exceptions are lead and petroleum hydrocarbon compounds which do not have Method B levels. For these constituents, shaded cells indicate that value exceeds site-specific background concentration and Method A human health-based soil criteria (Table 9).

3. Bolded values indicate that value exceeds site-specific background concentration and human health-based soil criteria for protection of groundwater.

4. Site-specific background concentrations and soil criteria used for comparison are presented in Table 9.

5. Not analyzed or not applicable

6. nd = Non-detect.

Table 11 - Summary of Contaminants of Concern and Cleanup Levels

Media of Concern and Area of Interest	Contaminant of Concern	Cleanup Level	Basis
Groundwater and Surface Water Potentially Used for Drinking Water: All Areas Concentration in ug/L	Aluminum	16,000	a
	Cadmium	5.00	
	Copper	592	
	Lead	15.0	
	Zinc	4,800	
Surface Water and Groundwater Discharging to Surface Water: All Areas Concentration in ug/L	Aluminum	142	b
	Cadmium (e)	0.050	
	Copper (e)	1.45	
	Iron	1,000	
	Lead (e)	0.169	
	Zinc (e)	13.6	
Soil: Tailings Piles 1, 2, and 3 Concentration in mg/kg	Cadmium	5.5	e
	Copper	85	e
	Thallium	0.36	d
	Zinc	136	d
Soil: East and West Waste Rock Piles Concentration in mg/kg	Barium	164	d
	Chromium	29	e
	Copper	46	e
	Lead	118	e
	Molybdenum	8.8	d
	Thallium	0.36	d
	Zinc	136	d
Soil: Honeymoon Heights Waste Rock Piles Concentration in mg/kg	Barium	164	d
	Copper	46	e
	Lead	118	e
	Mercury	0.93	d
	Molybdenum	8.8	d
	Silver	3.9	e
	Thallium	0.36	d
	Zinc	136	d
Soil: Ballfield Area Concentration in mg/kg	Copper	46	e
Soil: Holden Village Concentration in mg/kg	Zinc	136	d
Soil: Downslope from Honeymoon Heights Concentration in mg/kg	Arsenic	16	c
	Copper	288	e
	Mercury	0.43	d
	Selenium	1.4	d
	Zinc	177	d
Soil: Lower West Area-East Concentration in mg/kg	Aluminum	17,600	d
	Arsenic	16	c
	Barium	133	d
	Cadmium	12	e
	Copper	110	d
	Lead	121	e
	Mercury	0.43	d
	Molybdenum	2.9	d
	Selenium	1.4	d
	Thallium	0.13	d
	Zinc	177	d
Soil: Lower West Area-West Concentration in mg/kg	Arsenic	16	c
Soil: Wind-Blown Tailings Area Concentration in mg/kg	None	--	--

Table 11 - Summary of Contaminants of Concern and Cleanup Levels

Media of Concern and Area of Interest	Contaminant of Concern	Cleanup Level	Basis
Soil: Lagoon Concentration in mg/kg	Aluminum	17,600	d
	Barium	133	d
	Cadmium	14	e
	Copper	110	d
	Lead	118	e
	Molybdenum	2.9	d
	Thallium	1	e
	Zinc	177	d
	TPH-Diesel	200	e
	TPH-Heavy Oil	200	e
Soil: Maintenance Yard Concentration in mg/kg	Aluminum	18,200	d
	Arsenic	4.8	c
	Barium	164	d
	Cadmium	14	e
	Copper	70	e
	Lead	118	e
	Molybdenum	8.8	d
	Zinc	136	d
	TPH-Gasoline	100	e
	TPH-Diesel	200	e
	TPH-Heavy Oil	200	e
Soil: Ventilator Portal Surface Water Retention Area (SRA) Concentration in mg/kg	Aluminum	18,200	d
	Barium	164	d
	Copper	70	e
	Molybdenum	8.8	d
	Zinc	136	d

Table 11 - Summary of Contaminants of Concern and Cleanup Levels

Media of Concern and Area of Interest	Contaminant of Concern	Cleanup Level	Basis
Sediment Concentration in mg/kg	Aluminum	Determination of protectiveness based on bioassay results	f
	Beryllium		
	Cadmium		
	Chromium		
	Copper		
	Iron		
	Lead		
	Manganese		
	Mercury		
	Nickel		
	Silver		
	Zinc		

Notes:

(a) Cleanup level based on state or federal drinking water standards or cleanup levels protective of the drinking water pathway; see Table 2.

(b) Cleanup level based on state or federal surface water quality criteria or background, if higher; see Table 3.

(c) Cleanup level based on human health risk (MTCA Method B) (set at background); see Table 9.

(d) Cleanup level based on ecological risk (set at background); see Table 9 in ASFS. Also see Note 5 below.

(e) Cleanup level based on ecological risk; see Table 9 of ASFS. Also see Note 5 below.

(f) Constituent of concern list based on freshwater sediment TBCs; see Table 11 of the Proposed Plan. For information on bioassay requirements see Table 7.

General Notes:

1. Cleanup levels for soil were identified using data from Tables 9 and 12 as follows: The human health-based cleanup level for each constituent and AOI is the lowest human-health-based potential chemical-specific ARAR or TBC or the background level of the corresponding background area, whichever is greater. The ecological-based cleanup level for each constituent and AOI is the site-specific ecological risk-based level or the background level of the corresponding background area, whichever is greater. For media/areas with both human health and ecological exposure pathways, the cleanup level is based on the lower of the lowest ecological or human health criteria identified as described above, or background, if higher.

2. Sampling data not currently available for Former Mill Building area; contaminants of concern and cleanup levels will be identified by Agencies when data are available.

3. Cleanup levels presented for soil do not include those constituents with concentrations are less than background.

4. Cleanup levels for published and calculated values typically shown to two or three significant figures.

5. The COCs identified for soil are modified from those listed in the ASFS based on the results of additional evaluations of site-specific plant and soil invertebrate tissue concentrations (Houkal and Dagel 2011).

Table 12 - Terrestrial Ecological Hazard Quotients for Soil

Contaminants of Concern	Receptor	Tailings Piles 1, 2, & 3	East & West Waste Rock Piles	Honeymoon Heights Waste Rock Piles	Ballfield Area	Holden Village	Wind-Blown Tailings Area (a)	Area Downslope from Honeymoon Heights	Lower West Area East	Lower West Area West	Lagoon	Maintenance Yard	Surface Water Retention Area
Aluminum	Plants								3		650	500	400
	Invertebrates								-		-	-	-
	Wildlife								4		-	-	-
Arsenic	Plants							1	1	1		3	
	Invertebrates							0.3	0.3	0.4		1	
	Wildlife							0.2	0.3	0.1		0.5	
Barium	Plants		1	1			0.4		1		1	1	1
	Invertebrates		1	1			1		1		1	2	2
	Wildlife		4	3			1		3		3	7	6
Cadmium	Plants	1							4		6	1	
	Invertebrates	0.1							1		1	0.2	
	Wildlife	4							10		10	2	
Chromium	Plants		1										
	Invertebrates		1										
	Wildlife		2										
Copper	Plants	8	2	3	1		1	6	200		300	50	30
	Invertebrates	10	30	30	2		1	6	50		300	40	30
	Wildlife	4	6	7	0.4		1	5	70		100	20	9
Lead	Plants		0.03	4			0.1		1		7	9	
	Invertebrates		2	20			0.02		0.3		0.5	1	
	Wildlife		2	20			0.3		5		7	9	
Mercury	Plants			1				1	0				
	Invertebrates			30				20	10				
	Wildlife			1				0	0				
Molybdenum	Plants		7	10			3		40		40	8	11
	Invertebrates		-	-			-		-		-	-	-
	Wildlife		2	3			1		10		10	2	3
Selenium	Plants							5	20				
	Invertebrates							1	2				
	Wildlife							1	6				
Silver	Plants			0.015			0.002						
	Invertebrates			-			-						
	Wildlife			2			0.1						
Thallium	Plants	0.07	0.06	0.14					0.1		3		
	Invertebrates	-	-	-					-		-		
	Wildlife	40	60	200					100		-		
Zinc	Plants	10	6	3		1	1	6	100		100	20	5
	Invertebrates	20	8	4		2	1	8	100		200	30	6
	Wildlife	5	3	1		1	0.4	1	50		70	9	2
TPH-Gasoline	Plants											-	
	Invertebrates											10	
	Wildlife										-	0.2	
TPH-Diesel	Plants										-	-	
	Invertebrates										5	60	
	Wildlife										0.2	2	
TPH-Heavy Oil	Plants										-	-	
	Invertebrates										6	50	
	Wildlife										0.2	2	

Notes:
1. Blank cells indicate that chemical is not a contaminant of concern for the particular area of interest.
2. – No ecological screening level available for this receptor.
3. Shaded cells indicate hazard quotient is greater than 1. Hazard quotients (HQs) were calculated by dividing contaminant concentrations (see Table 10 in the ASFS) by levels considered protective of terrestrial ecological receptor (see ASFS, Appendix E). HQs are reported to one significant figure as suggested by EPA (2004a).

Table 13 - Ecological Exposure Pathways of Concern

Exposure Medium	Receptor	Exposure Routes
Soil	Terrestrial Invertebrates	Dermal contact with contaminants of concern in soil and ingestion
	Terrestrial Plants	Uptake of contaminants of concern via root system
	Wildlife	Contact/ingestion of soil, ingestion of plants, invertebrates, and prey species
Groundwater	Aquatic Invertebrates and Fish	See Surface Water
Surface Water (including Vernal Pools)	Aquatic Invertebrates and Fish	Dermal contact with contaminants of concern in surface water, and ingestion
Sediment	Benthic Invertebrates	Dermal contact with contaminants of concern and ingestion

Table 14 - Description of Alternatives and Sub-Alternatives 1 through 10

Estimated Cost in Millions	Document Reference[a]	Alternative
$2.73	DFFS, Section 6.2	**Alternative 1** Although Intalco referred to this as a no action alternative, Alternative 1 includes removal and disposal of Main Portal debris and metal precipitates, institutional controls, and monitoring.
$17.3 to 18.8	DFFS, Section 6.4	**Alternatives 2a and 2b** Alternatives 2a and 2b would divert surface water run-on upgradient of the waste rock piles, former Mill Building, and tailings piles; and regrade and revegetate limited portions of the tailings piles. Alternative 2a leaves the Main Portal drainage unchanged, while 2b would include hydrostatic bulkheads on the 1500 Level to control discharge from underground.
$27.1 to 28.2	DFFS, Section 6.5	**Alternatives 3a and 3b** Alternatives 3a and 3b use the components of Alternative 2 and also include collection and treatment of groundwater from the Upper West Area, Main Portal discharge, and seep discharge downgradient of Honeymoon Heights. A groundwater barrier wall and collection system would be constructed immediately north of the former mill and waste rock piles in the West Area.
$33.2 to 67.5	DFFS, Section 6.6	**Alternatives 4a, 4b, and 4c** Alternatives 4a and 4b include constructing a groundwater barrier wall between collection trenches and Railroad Creek. Alternative 4a treats groundwater collected adjacent to Tailings Piles 1 and 3, while 4b treats groundwater from Tailings Piles 1, 2, and 3. Alternative 4c differs from 4a and 4b by relocating Railroad Creek from Tailings Pile 1 to downstream of Tailings Pile 3.
$40.4 to $74.3	DFFS, Section 6.7	**Alternatives 5a, 5b, 5c, and 5d** Alternatives 5a, 5b, 5c, and 5d would collect and treat groundwater from the Upper West Area, Honeymoon Heights, and the Main Portal discharge and would include limited regrading and revegetation of portions of the tailings. Under Alternatives 5a and 5b barrier walls and groundwater collection systems would be constructed along the waste rock piles and former Mill Building, and along 2,000 feet of Railroad Creek extending west from the Copper Creek Diversion. Alternatives 5c and 5d would not include a groundwater barrier wall along the tailings piles but would relocate the creek from Tailings Pile 1 to downstream of Tailings Pile 3 and modify the abandoned channel for collection of seepage and groundwater.
$74.5 to $77.4	DFFS, Section 6.8	**Alternatives 6a and 6b** Alternatives 6a and 6b include the components of Alternatives 3 and 4c. Two additional remedial components would be construction of a Lower West Area barrier wall and a 3,500-foot-long groundwater collection system and relocation of Railroad Creek from Tailings Pile 1 past Tailings Pile 3. The abandoned section of creek channel would be modified to collect seepage and groundwater. Limited regrading and revegetation of portions of the tailings piles would be done. Alternatives 6a and 6b would treat groundwater collected at three locations: in the LWA, near the confluence of Railroad and Copper Creeks, and east of Tailings Pile 3. The location of the two eastern treatment plants would require additional creek relocation and elimination of wetlands.
$100	DFFS, Section 6.9	**Alternative 7** Alternative 7 uses the water management and treatment components described in Alternative 3. Tailings Piles 1 and 3 would be consolidated onto Tailings Pile 2, capped with a low-permeability membrane and soil, and riprap placed along the toe to reduce the potential for erosion, slope failures, and scour. Waste rock piles would be partially capped.
$113	DFFS, Section 6.10	**Alternative 8** Consolidation and capping of Tailings Piles 1 and 3 and the Waste Rock Piles would be the same as Alternative 7. A 3,500-foot-long groundwater barrier would be constructed on the west, north, and east sides of the consolidated tailings pile. The collected groundwater would be treated in unlined treatment ponds. The Main Portal drainage, Honeymoon Heights seeps, and SP-23 and SP-12 seeps would be collected and treated.
$36.0 to $38.2	SFS, Section 3.3	**Alternative 9** Alternative 9 is the same as Alternative 3b, except that Alternative 9 includes installation of four wells to extract groundwater below Tailings Pile 1 and installation of a seep interception system to collect flow from seeps SP-1 and SP-2.
$55.10	SFS, Section 3.4	**Alternative 10** Alternative 10 would include a partially penetrating groundwater barrier and collection system adjacent to Railroad Creek in the LWA and along Tailings Piles 1 and 3. Waste rock would be regraded to improve stability. Closure of the tailings and main East and West Waste Rock Piles would include placement of a 1-foot-thick soil cap. Ferricrete would be excavated from Railroad Creek. Seeps SP-3 and SP-4, on the northern edge of Tailings Pile 2, and the Honeymoon Heights seeps SP-12 and SP-23, would be collected and treated.

Note:
(a) DFFS - Draft Final Feasibility Study, SFS - Supplemental Feasibility Study

Table 15 - Summary Comparison of Alternatives 11M, 13M, and 14

<table>
<tr><th>Alternative 11M</th><th>Alternative 13M</th><th>Alternative 14</th></tr>
<tr><td colspan="3">Groundwater Containment and Collection for Treatment</td></tr>
<tr><td>Use fully penetrating barrier for containment and collection for treatment of groundwater below WMAs:

a) the Lower West Area and Tailings Pile 1: and

b) Tailings Piles 2 and 3.</td><td>Use fully penetrating barrier for containment and collection for treatment all groundwater below the Lower West Area and Tailings Pile 1.

Collect a portion of groundwater below Tailings Pile 2 that flows into the former Railroad Creek channel for treatment.

No containment or collection for treatment of the remainder of impacted groundwater below Tailings Pile 2 or Tailing Pile 3, except as part of an unspecified future contingent action.</td><td>Use fully penetrating barrier for containment and collection for treatment of groundwater below WMAs:

a) the Lower West Area and Tailings Pile 1; and
b) Tailings Piles 2 and 3.

The barrier wall and collection system would be installed in two phases. During the first phase, a barrier wall would be constructed downgradient from the Lower West Area and Tailings Pile 1; during the second phase, a barrier wall would be installed downgradient from Tailings Piles 2 and 3.

The period between the first and second phase presents an opportunity for Intalco to collect data in an effort to support a proposal to modify the second phase. The ROD allows for the collection of additional data following implementation of the first phase cleanup components and includes the provision that the barrier wall design could be modified or would not need to be installed, if demonstrated to satisfy ARARs and be protective within a timeframe comparable to the Selected Remedy. The second phase of the remedy would not need to be installed only if it can be demonstrated to the Agencies' satisfaction that:

1. Groundwater concentrations are reduced to achieve surface water cleanup levels before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates; and
2. One of the following: a) groundwater meets MCLs below Tailings Piles 2 and 3, as well as throughout the plume; or b) groundwater that exceeds drinking water standards will be contained within a WMA; or c) an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective is justified.

Such a change would require a ROD Amendment. The basis for the change must be demonstrated within three years of substantial completion of the first phase of remedial construction, so that a decision can be made in the fourth year. Unless the second phase groundwater barrier and collection system is eliminated, the second phase of remedial action is expected to be designed in the fifth year and constructed immediately thereafter.</td></tr>
</table>

Note:
Alternative 12, the No Action Alternative, is not presented in the table because it does not include any of the components that Alternatives 11M, 13M, and 14 address.

Table 15 - Summary Comparison of Alternatives 11M, 13M, and 14

Alternative 11M	Alternative 13M	Alternative 14
Railroad Creek		
Remove ferricrete, enhance existing riprap, and monitor sediment quality over time.	Realign a portion of the channel to the north to avoid having to move the toe of the tailings piles, thus isolating ferricrete in the former channel. Use the former channel for collection or conveyance of groundwater to treatment.	Similar to or the same as Alternative 13M. The realignment may be extended farther west to avoid the need to move the toe of Tailings Pile 1.
Copper Creek		
Modify channel to improve resistance to erosion and scour.	Modify channel to improve resistance to erosion and scour, and extend to intersect relocated Railroad Creek channel.	Similar to or the same as Alternative 13M.
Copper Creek Diversion		
Replace existing hydroelectric outfall channel with lined channel or culvert to Railroad Creek to avoid contact with tailings.	Similar to or the same as Alternative 11M.	Similar to or the same as Alternative 11M.
Wetland East of Tailings Pile 3		
Wetlands could be restored following elimination of groundwater impacts from Tailings Pile 3.	Wetlands would become the site of a new groundwater treatment system, which would require mitigation under various ARARs.	Similar to or the same as Alternative 13M.

Alternative 11M	Alternative 13M	Alternative 14
Tailings Piles 1, 2, and 3		
Close and cap in accordance with the presumptive requirements of Limited Purpose Landfill regulations and other ARARs. Regrade all slopes for stability, including moving toe of slope away from Railroad and Copper Creeks as needed for construction of: ■ Groundwater barrier; ■ Groundwater collection trench; ■ Maintenance access road; and ■ Toe buttress. Cap (2 feet of soil with geomembrane assumed for cost estimating). Cap would require long-term maintenance to protect integrity of membrane.	Close and cap in accordance with the performance requirements of Limited Purpose Landfill regulations. Regrade north-facing slopes for stability, including construction of a toe buttress. Relocate Railroad Creek to avoid moving toe of slope adjacent to creek. Cap (6 to 12 inches of soil, gravel, slash, and/or amended tailings), and revegetated.	Close and cap in accordance with the performance requirements of Limited Purpose Landfill regulations and other ARARs. Regrade all slopes for stability, including moving toe of slope away from Copper Creek and relocating a section of Railroad Creek as needed for construction of: ■ Groundwater barrier; ■ Groundwater collection trench; ■ Maintenance access road; and ■ Toe buttress. Cap as determined during Remedial Design (2 feet of soil assumed for cost estimating) and revegetate.
Construct upgradient diversion swale/French drain to divert stormwater run-on. Limited purpose landfill on top for sludge.	Construct upgradient diversion swale/French drain to divert stormwater run-on. Limited purpose landfill on top for sludge.	Construct upgradient diversion swale/French drain to divert stormwater run-on. Limited purpose landfill on top for sludge.

Table 15 - Summary Comparison of Alternatives 11M, 13M, and 14

Alternative 11M	Alternative 13M	Alternative 14
East and West Waste Rock Piles		
Close and cap in accordance with the presumptive requirements of Limited Purpose Landfill regs and other ARARs. Regrade slopes for stability. Excess waste rock would be placed on top of piles or relocated to tailings piles. Cap as determined during Remedial Design (2 feet of soil with geomembrane assumed for cost estimating). Cap would require long-term maintenance to protect integrity of membrane. Construct upgradient diversion swale/French drain to divert stormwater run-on.	Close and cap in accordance with the performance requirements of Limited Purpose Landfill regs. Regrade slopes for stability. Excess waste rock would be relocated to former Mill Building site or tailings piles. Cap with 6 to 12 inches of soil and revegetate. Construct upgradient diversion swale/French drain to divert stormwater run-on.	Close and cap in accordance with the performance requirements of Limited Purpose Landfill regs and other ARARs. Regrade slopes for stability. Excess waste rock would be placed on top of piles, former Mill Building site or relocated to tailings piles. Cap as determined during Remedial Design (2 feet of soil assumed for cost estimating) and revegetate. Construct upgradient diversion swale/French drain to divert stormwater run-on.
Honeymoon Heights Waste Rock Piles		
Remove waste rock for consolidation into tailings piles prior to capping. Collect and treat seeps SP-12 and SP-23 downslope of waste rock piles. Monitor groundwater to determine whether additional groundwater collection for treatment is needed.	No action on waste rock piles. Collect and treat seeps SP-12 and SP-23 downslope of waste rock piles.	Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances. Collect and treat seeps SP-12 and SP-23 downslope of waste rock piles. Monitor groundwater to determine whether additional groundwater collection for treatment is needed.
Impacted Areas Downslope of HHWRP		
Remove impacted soils and consolidate into tailings piles prior to capping.	No action.	Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances.

Table 15 - Summary Comparison of Alternatives 11M, 13M, and 14

Alternative 11M	Alternative 13M	Alternative 14
Ballfield Area		
Remove impacted soils from areas with low habitat value and consolidate into tailings piles prior to capping. Use *in situ* treatment as needed to raise pH to reduce mobility and bioavailability of hazardous substances.	No action.	Similar to or the same as Alternative 11M.
Holden Village		
Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances.	No action.	Similar to or the same as Alternative 11M.
Lower West Area		
Remove impacted soils from areas with low habitat value and consolidate into tailings piles prior to capping. Use *in situ* treatment as needed to raise pH to reduce mobility and bioavailability of hazardous substances.	No action.	Similar to or the same as Alternative 11M.
Lagoon Area		
Remove impacted soils and consolidate into tailings piles prior to capping, and backfill excavation.	Remove impacted soils and consolidate into tailings piles prior to capping. Incorporate excavation into groundwater treatment facility.	Similar to or the same as Alternative 13M.
Wind-blown Tailings Area		
Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances.	Remove (or cap) impacted soils in area of creek realignment. No action in remainder of area.	Remove impacted soils in area of creek realignment. Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances.

Table 15 - Summary Comparison of Alternatives 11M, 13M, and 14

Alternative 11M	Alternative 13M	Alternative 14
Maintenance Yard		
Cap with concrete or asphalt paving.	Cap with concrete or an impermeable liner and gravel	Cap with concrete paving.
Former Mill Building		
Demolish building as needed to remove soils and processing residuals for consolidation in Tailings Piles prior to capping. Dispose of Dangerous Waste in a licensed facility, if needed. The disturbed area would be stabilized to prevent long-term erosion, and revegetated. Construct upgradient diversion swale/French drain to divert stormwater run-on.	Demolish building superstructure. Remove contaminated materials and/or cap with waste rock and 6 inches of soil, and revegetate. Construct upgradient diversion swale/French drain to divert stormwater run-on.	Demolish building as needed to remove soils and processing residuals for consolidation in Tailings Piles prior to capping. Dispose of Dangerous Waste in a licensed facility, if needed. The disturbed area would be stabilized to prevent long-term erosion, and revegetated. Construct upgradient diversion swale/French drain to divert stormwater run-on.
Ventilator Portal Surface Water Retention Area		
Remove impacted soils and consolidate into tailings piles prior to capping, and backfill excavation.	Similar to or the same as Alternative 11M.	Similar to or the same as Alternative 11M.

Table 15 - Summary Comparison of Alternatives 11M, 13M, and 14

Alternative 11M	Alternative 13M	Alternative 14
Groundwater Treatment Facilities		
Single treatment facility located north of Railroad Creek and east of Tailings Pile 3 would rely on mechanical flow by pumping influent. Treatment by pH adjustment and sedimentation, subject to enhancement based on treatability and performance testing.	Two treatment systems, one in Lower West Area and the other east of Tailings Pile 3 and south of Railroad Creek, both rely on gravity flow. Treatment by pH adjustment and sedimentation, subject to enhancement based on treatability and performance testing.	Similar to or the same as Alternative 13M.

Notes:
Alternative 12, the No Action Alternative was also compared with these alternatives in the ROD.
Summary does not include institutional controls or other measures that are similar for each alternative.

Table 16 - Chemical-Specific ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement	Comparison of Alternatives in Meeting ARAR Requirements: Alternative 11M	Alternative 13M	Alternative 14
Federal Regulatory Requirement	Surface Water	National Recommended Water Quality Criteria [Federal Water Pollution Control Act (Clean Water Act) 33 U.S.C. § 1314(a), Section 304(a)] 40 C.F.R. § 131.11(b)(1).	Applicable	National Recommended Water Quality Criteria (NWQC) is guidance established by the EPA for evaluating toxics effects on human health and aquatic organisms. The 1999 NWQC criteria are applicable to protection of aquatic life at the Site [WAC 173-340-730(3)(b)(i)(B)] as these were the NWQC criteria available when the MTCA regulations were last updated. Even if not applicable, the 1999 criteria are relevant and appropriate for protection of aquatic life under MTCA [WAC 173-340-710(4)].	The Selected Remedy will comply with these regulations by implementing remedial actions which control the release of hazardous substances above cleanup levels to surface water including: site runoff, seeps, the Main Portal discharge, and contain and treat groundwater at the boundaries of the Waste Management Areas (WMAs) and achieving the cleanup levels at the point of discharge from the treatment plant.	This Alternative satisfies chemical-specific ARARs for surface water in Railroad Creek and the Copper Creek Diversion based on protection of aquatic life as discussed in ASFS Sections 6.2.1.2.1 and 6.2.3.2.1.	As discussed in ASFS Sections 6.2.2.1 and 6.2.2.2.1, current information is not sufficient to allow the Agencies to conclude that remedial actions proposed under this alternative to address discharges from Tailings Piles 2 and 3 (including natural attenuation processes) would be sufficient to meet surface water ARARs and be protective of aquatic life in Railroad Creek.	This Alternative satisfies chemical-specific ARARs for surface water in Railroad Creek and the Copper Creek Diversion based on protection of aquatic life as discussed in ASFS Sections 6.2.1.2.1 and 6.2.3.2.1.
			Relevant and Appropriate	The 2004 NWQC and the 2007 copper criterion* are relevant and appropriate for protection of aquatic life at the Site under CERCLA [Section 121(d)(2)]. The 2006 NWQC and subsequent NWQC (such as the 2007 copper criterion) are also relevant and appropriate for protection of aquatic life under MTCA [WAC 173-340-710(4)]. * The Aquatic Life Ambient Freshwater Quality Criteria - Copper 2007 Revision (2007 copper criterion, EPA 2007) was published in the Federal Register on February 22, 2007. The 2007 copper criterion provides a basis to determine acute and chronic concentrations for protection of aquatic organisms based on the Biotic Ligand Model. The model determines concentrations that are protective based on an analysis of ambient conditions for a number of parameters. To date, relatively few data have been collected at the Site to provide a basis for predicting acute and chronic copper concentrations for Railroad Creek under this criterion. The cleanup level established at the time of this ROD is based on the background concentration for dissolved copper in accordance with WAC 173-340-730(5)(c). This level could later be modified in accordance with ARARs based on additional data collection as part of implementing the remedy.				
Federal Regulatory Requirement	Surface Water	National Toxics Rule (NTR) [40 C.F.R. Part 131].	Applicable	The National Toxics Rule (NTR) established numeric water quality standards for protection of human health and aquatic organisms for states that did not fully comply with Section 303(c)(2)(C) of the Clean Water Act (CWA). The State of Washington is required to comply with certain standards in the NTR [40 C.F.R. § 131.36(d)(14)]. MTCA identifies the NTR as an ARAR [WAC 173-340-730(3)(b)(i)(C)]. The NTR standards mandated for Washington are applicable for the Site.	The Selected Remedy will comply with the applicable NTR standards mandated for Washington. The Selected Remedy will comply with these regulations by implementing remedial actions that control the release of hazardous substances above cleanup levels to surface water including: site runoff, seeps, the Main Portal discharge, and groundwater at the boundaries of the Waste Management Areas (WMAs). The Selected Remedy will achieve the cleanup levels at the point of compliance for the treatment plant discharge.	This Alternative would satisfy chemical-specific ARARs for surface water in Railroad Creek and the Copper Creek Diversion based on protection of aquatic life as discussed in ASFS Sections 6.2.1.2.1 and 6.2.3.2.1.	The Alternative may not meet chemical-specific ARARs for surface water as discussed in ASFS Sections 6.2.2.1 and 6.2.2.2.1. It is unlikely that surface water cleanup levels based on protection of aquatic life would be met in Railroad Creek downstream from Tailings Piles 2 and 3, because of uncontrolled discharge of groundwater from Tailings Piles 2 and 3 to surface water.	This Alternative would satisfy chemical-specific ARARs for surface water in Railroad Creek and the Copper Creek Diversion based on protection of aquatic life as discussed in ASFS Sections 6.2.1.2.1 and 6.2.3.2.1.
State Regulatory Requirement	Surface Water	Washington State Water Quality Standards for Surface Water [RCW 90.48; Chapter 173-201A WAC].	Applicable	Washington State has established aquatic life criteria for hazardous substances in freshwater. These provisions and standards in Chapter 173-201A WAC are applicable for the Site, including the antidegradation policy (Section 300) and the narrative criteria (Section 260).	The Selected Remedy will comply with these regulations by implementing remedial actions which control the release of hazardous substances above cleanup levels to surface water including: site runoff, seeps, the Main Portal discharge, and groundwater at the boundaries of the Waste Management Areas (WMAs). The Selected Remedy will achieve the cleanup levels at the point of compliance for the treatment plant discharge.	This Alternative would satisfy chemical-specific ARARs for surface water in Railroad Creek and the Copper Creek Diversion based on protection of aquatic life as discussed in ASFS Sections 6.2.1.2.1 and 6.2.3.2.1.	The Alternative is unlikely to meet chemical-specific ARARs for surface water as discussed in ASFS Sections 6.2.2.1 and 6.2.2.2.1. It is unlikely that surface water cleanup levels based on protection of aquatic life would be met in Railroad Creek downstream from Tailings Piles 2 and 3 because of uncontrolled discharge of groundwater from Tailings Piles 2 and 3 to surface water.	Implementation of cleanup actions under this Alternative would satisfy chemical-specific ARARs for surface water in Railroad Creek and the Copper Creek Diversion based on protection of aquatic life as discussed in ASFS Sections 6.2.1.2.1 and 6.2.3.2.1.

Table 16 - Chemical-Specific ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement	Comparison of Alternatives in Meeting ARAR Requirements		
						Alternative 11M	Alternative 13M	Alternative 14
Federal Regulatory Requirement	Surface Water and Groundwater	Maximum Contaminant Levels (MCLs) and National Maximum Contaminant Level Goals (MCLGs) [40 C.F.R. Part 141].	Relevant and Appropriate	Surface water and groundwater at the Site are potable under MTCA [Chapter 173-340 WAC]. Under the Safe Drinking Water Act [SDWA; 42 U.S.C. § 300 et seq.], EPA establishes health goals based on risk and sets legal limits—maximum contaminant levels (MCLs)—to help ensure consistent quality of the water supply. EPA has also established health-based MCL goals (MCLGs) for public water systems. MCLs and nonzero MCLGs are relevant and appropriate for surface water and groundwater at the Site. The Agencies have determined that secondary MCLs, which are not health-based but rather based on aesthetic criteria, are not ARARs at the Site.	The Selected Remedy establishes the downgradient boundaries of the WMAs as the groundwater Point of Compliance (POC) for MCLs and MCLGs. Containment and treatment of groundwater in the WMAs limits contaminant migration at the POCs and will comply with the applicable MCLs and MCLGs for groundwater downgradient of the WMAs	Drinking water ARARs for surface water would be met. Under the Alternative, groundwater exceeding cleanup levels would be contained within Waste Management Areas (WMAs) at the Site. Outside the WMAs, groundwater drinking water ARARs would be met. Surface water would also meet MCLs under this alternative.	Drinking water ARARs for surface water would be met. The Alternative did not include groundwater containment around Tailings Piles 2 and 3 and so does not include a WMA. Drinking water ARARS in groundwater under Tailings Piles 2 and 3 would not be met. Surface water would meet MCLs under this alternative.	Drinking water ARARs for surface water would be met. Under the Alternative, groundwater exceeding cleanup levels would be contained within WMAs at the Site. Outside the WMAs, groundwater drinking water ARARs would be met. Surface water would also meet MCLs under this alternative.
State Regulatory Requirement	Surface Water and Groundwater	Washington State Drinking Water Standards [RCW 119A; Chapter 246-290 WAC].	Applicable	Washington State has established health-based MCLs to protect consumers using public water supplies. MTCA identifies state MCLs as being directly applicable to potential surface water and groundwater sources of drinking water at the Site.	The Selected Remedy restricts future groundwater contamination to within the WMAs. Except for groundwater contained within the WMAs, the Selected Remedy will comply with the MTCA requirement that drinking water standards for surface water and groundwater at the Site be achieved. Institutional controls will be used to restrict use of groundwater within the WMAs.	Drinking water ARARs for surface water would be met. Drinking water ARARs would not be met in portions of the groundwater. Those portions of the groundwater would be within the areas designated as WMAs.	Drinking water ARARs for surface water would be met. Drinking water ARARS would not be met in portions of the groundwater. The Alternative did not include groundwater containment around the Tailings Piles 2 and 3 and so would not be designated as a WMA.	Drinking water ARARs for surface water would be met. Drinking water ARARs would not be met in portions of the groundwater. Those portions of the groundwater would be within the areas designated as WMAs.
State Regulatory Requirement	Surface Water, Groundwater, and Soil	Washington State Model Toxics Control Act [RCW 70.105D; Chapter 173-340 WAC].	Applicable	The Model Toxics Control Act (MTCA) is directly applicable to the surface water, groundwater, and soil at the Site and provides ARARs under CERCLA where MTCA is more stringent. MTCA surface water cleanup standards are based on the most stringent of a suite of values aimed at protecting human health and aquatic receptors. MTCA groundwater cleanup standards are generally based on the highest beneficial use and reasonable maximum exposure expected under current and potential future Site uses. Where groundwater flows into surface water, surface water cleanup levels apply. MTCA has provisions for soil cleanup that are based on protection of human health and terrestrial ecological receptors, as well as groundwater and/or surface water resources.	The Selected Remedy includes actions taken to comply with these cleanup standards – it uses consolidation and capping of wastes, containment and treatment of groundwater, and *in situ* treatment of soil to address exposure pathways for human health and ecological receptors. The selected remedy identifies the potential need for future soil excavation in Holden Village or other areas of the Site if future ground disturbances or changes in land use make such excavation appropriate.	The Alternative would attain MTCA cleanup standards. Under Alternative 11M, contaminated groundwater would be contained and treated before entering the surface water.	The Alternative would not attain cleanup standards in all portions of the Site. It is unlikely that MTCA groundwater and surface water cleanup levels based on protection of aquatic life would be met in Railroad Creek downstream from Tailings Piles 2 and 3, because of uncontrolled discharge of groundwater from Tailings Piles 2 and 3 to surface water. The Alternative does not include actions to attain MTCA soil cleanup levels for the protection of terrestrial ecological receptors where necessary.	The Alternative would attain MTCA cleanup standards.[1] Under Alternative 14, contaminated groundwater would be contained and treated before entering the surface water.

[1] MTCA is being independently applied to this action. In that application, Alternatives 11M and 14 satisfy MTCA's requirement that a remedy be "permanent to the maximum extent practicable" differently. Overall, Ecology has determined that while Alternative 11M is more permanent that Alternative 14 (principally by removing waste rock and impacted soil in the Honeymoon Heights Area rather than relying on *in situ* treatment), it would be less protective than Alternative 14 at a greater overall cost. Alternative 14, thus, better satisfies the MTCA requirements than Alternative 11M because it relies on permanent solutions to the maximum extent practicable.

Table 17 – Action-Specific ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement	Comparison of Alternatives in Meeting ARAR Requirements: Alternative 11M	Alternative 13M	Alternative 14
Federal Regulatory Requirement	Surface Water	Federal Water Pollution Control Act--National Pollution Discharge Elimination System [Clean Water Act; 33 U.S.C. § 1342, Section 402] and Implementing Regulations.	Applicable and relevant and appropriate	The NPDES program establishes requirements for point source discharges including stormwater runoff. In particular for the Site, these regulations are applicable for any point source discharge of contaminated water (e.g., discharge following treatment of groundwater), stormwater runoff at the Site, and management of stormwater runoff during construction where the remedial construction site involves 1 acre or more.	The Selected Remedy will comply with NPDES requirements for groundwater that is collected and treated downgradient of the Waste Management Areas (WMAs). The boundary of the WMAs are Points of Compliance (POCs) at which compliance with drinking water standards will be achieved. The containment of groundwater will reduce surface water impacts resulting from contaminated groundwater discharging into surface water in Railroad Creek. Stormwater management will be addressed during remedial design and construction phases of remedy implementation.	The Alternative would meet the ARAR requirements for point source discharge and stormwater runoff. Control of stormwater runoff during remedial construction would be addressed during the design and construction phases of cleanup actions.	The Alternative uses remedial actions that would not completely meet the ARAR requirements.. Alternative 13M may collect the point source seeps SP-3 and SP-4 adjacent to Tailings Piles 2 and 3, but this flow could infiltrate through the existing creek channel, and therefore the Alternative would not actually capture these point sources. Control of stormwater runoff during remedial construction would be addressed during the design and construction phases of cleanup actions.	The Alternative uses remedial actions that would meet the ARAR requirements for point source discharge and stormwater runoff. Control of stormwater runoff during remedial construction would be addressed during the design and construction phases of cleanup actions.
Federal Regulatory Requirement	Surface Water	Federal Water Pollution Control Act--Water Quality Certification [Clean Water Act; 33 U.S.C. § 1341, Section 401] and Implementing Regulations.	Applicable for the treatment plant; otherwise Relevant and Appropriate	Section 401 of the CWA provides that applicants for a license or permit to conduct any activity, including, but not limited to, the construction or operation of facilities, which may result in discharges into the navigable waters, shall obtain certification from the state that discharges will comply with applicable water quality standards. While no formal certification will be required for the Site, substantive requirements will be applicable to remedial actions that require substantive compliance with federal permit equivalency (e.g., National Pollution Discharge Elimination System (NPDES), Section 404).	The Selected Remedy will comply with substantive requirements for discharge during the remedial design and construction phases of remedy implementation. Agencies will review design plans, remedy implementation activities, and operations of facilities to evaluate substantive compliance with federal permit equivalency. Agencies reviews will include operations of treatment facilities, or other remedy actions such as control and diversion of stormwater run-on at the Site.	Remedial actions in the Alternative would meet the substantive requirements to comply with applicable water quality standards for discharges into surface water.	The remedial actions implemented in the Alternative do not include a groundwater barrier that contains contaminant releases to groundwater from Tailings Piles 2 and 3. Alternative 13M would not comply with the substantive requirements for discharges to surface water.	Remedial actions in the Alternative would meet the substantive requirements to comply with applicable water quality standards for discharges into surface water.
State Regulatory Requirement	Surface Water	Washington State Industrial Stormwater General Permit, Chapter 90.48 RCW	Applicable and Relevant and Appropriate	Substantive requirements must be met for any Site activities that discharge stormwater to a surface water body or to a storm sewer system that drains to a surface water body.	The Selected Remedy will comply with substantive requirements related to stormwater discharge to surface water.	Remedial actions under these three alternatives would meet the substantive requirements to comply with applicable water quality standards for discharges into surface water.		
State Regulatory Requirement	Surface Water	Washington State Construction Stormwater General Permit Chapter 90.48 RCW	Applicable and Relevant and Appropriate	Substantive requirements must be met for any Site activities that discharge stormwater to a surface water body or to a storm sewer system that drains to a surface water body.	The Selected Remedy will comply with substantive requirements related to stormwater discharge to surface water.	This Alternative would meet the substantive requirements to comply with applicable water quality standards for discharges into surface water during Site remedial action construction activity.		
State Regulatory Requirement	Surface Water	Water Quality Standards for Surface Waters of the State of Washington-- Mixing Zones [RCW 90.48; WAC 173-201A-400].	Applicable or Relevant and Appropriate	In Washington State, mixing zones and the associated effluent limits are established for point sources in discharge permits, general permits, or orders. Mixing zones do not apply to discharges directly from the groundwater to surface water per WAC 173-340-730(6)(b). Prior to a mixing zone being authorized for a point source discharge, the conditions set forth in WAC 173-201A-400 must be met. This regulation is applicable to the discharge from a treatment plant.	The discharge of effluent from the water treatment facility must comply with the effluent limits established by Washington State Water Quality Standards to the extent that they are more stringent, and may include a mixing zone in accordance with WAC 173-201A -400.	The effluent discharge from the treatment plant is expected to satisfy the mixing zone requirements of WAC 173-201A-400, so that the Agencies may approve a mixing zone.	The effluent discharge from the treatment plant is expected to satisfy mixing zone requirements of WAC 173-201A-400, so that the Agencies may approve a mixing zone. The uncontrolled groundwater releases from Tailings Piles 2 and 3 to Railroad Creek will exceed surface water cleanup levels and no mixing zone is available for such discharges	The effluent discharge from the treatment plant is expected to satisfy the mixing zone requirements of WAC 173-201A-400,so that the Agencies may approve a mixing zone.

Table 17 – Action-Specific ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement	Comparison of Alternatives in Meeting ARAR Requirements		
						Alternative 11M	Alternative 13M	Alternative 14
State Regulatory Requirement	Surface Water, Groundwater, and Soil	Washington Model Toxics Control Act [RCW 70.105D; Chapter 173-340 WAC].	Applicable	MTCA establishes standards to clean up facilities where hazardous substances are located. These include action specific requirements related to non-permanent groundwater actions, see WAC 173-340-360(2)(c)(ii),limitations on the use of dilution and dispersion as part of a remedy, see WAC 173-340-360(g), and conditions related establishing conditional points of compliance in groundwater, see WAC 173-340-720(8)(c)&(d). Where these requirements are more stringent, they are applicable under CERCLA.[1]	The Selected Remedy will comply with both federal criteria and MTCA criteria. Where MTCA criteria are more stringent than federal, the MTCA requirements are applicable under CERCLA.	The Alternative would satisfy MTCA action-specific requirements in all portions of the Site where more stringent and therefore applicable under CERCLA.	Where MTCA is more stringent, the Alternative would not satisfy MTCA at all portions of the Site.[2] The Alternative does not meet the requirements set forth in WAC 173-340-720(8)(c)&(d) because this alternative does not implement all practicable methods of treatment.	The Alternative would satisfy MTCA action-specific requirements in all portions of the Site where more stringent and therefore applicable under CERCLA.
State Regulatory Requirement	Surface Water and Sediment	Hydraulic Code [RCW 77.55; Chapter 220-110 WAC].	Applicable	The Hydraulic Code requires that any construction activity that uses, diverts, obstructs, or changes the bed or flow of state waters must be done under the terms of a Hydraulics Project Approval permit issued by Washington State Department of Fish and Wildlife (WSDFW). Depending on the selected remedial action, substantive provisions of the Hydraulic Code are applicable at the Site, though no permit would be required.	During remedial design, portions of the Selected Remedy that modify Railroad Creek or Copper Creek or change the flow of state waters will be required to comply with the substantive requirements of a Hydraulics Project Approval permit.	The Hydraulic Code requirements would be addressed and met during the design phase of Alternative 11M.	The Hydraulic Code requirements would be addressed and met during the design phase of Alternative 13M.	The Hydraulic Code requirements would be addressed and met during the design phase of Alternative 14.
State Regulatory Requirement	Sediment	Washington State Sediment Management Standards [Chapter 173-204 WAC].	Relevant and Appropriate	The sediment management standards are relevant and appropriate to clean up of sediment at the Site. Monitoring following remedy implementation will be required to confirm protectiveness.	The Selected Remedy will comply with sediment management standards. The regrading and capping the tailings piles and waste rock piles reduce the risk of future erosion and sediment transport and impact on Railroad Creek and Copper Creek sediments. Iron precipitate (ferricrete) impacts in Railroad Creek will be controlled by source reduction through containment and treatment of groundwater prior to discharge into Railroad Creek and relocation of a portion of Railroad Creek to isolate existing ferricrete.	Alternative 11M includes removal of ferricrete in Railroad Creek, and sediment monitoring to determine whether additional sediment cleanup would be required to protect aquatic organisms. The Alternative would meet the State sediment management standards.	Alternative 13M includes isolation of ferricrete in Railroad Creek away from aquatic habitat. The alternative, however, does not contain contaminated groundwater under Tailings Piles 2 and 3. Future groundwater migration to surface water in Railroad Creek would adversely impact sediments. The Alternative does not meet the State sediment management standards.	Alternative 14 includes isolation of ferricrete in Railroad Creek away from aquatic habitat, and sediment monitoring to determine whether additional sediment cleanup would be required to protect aquatic organisms. The Alternative would meet the State sediment management standards.
State Regulatory Requirement	Surface Water	Dam Safety Chapter 173-175 WAC.	Applicable	This regulation provides for the comprehensive regulation and supervision of dams to reasonably secure safety to life and property and is applicable to the tailings piles (i.e., former tailings impoundments) at the Site.	The Selected Remedy will comply with dam safety regulations. The particular provisions of the regulation will be identified through the remedial design process.	The Dam Safety requirements would be addressed and met during the design phase of Alternative 11M.	The Dam Safety requirements would be addressed and met during the design phase of Alternative 13M.	The Dam Safety requirements would be addressed and met during the design phase of Alternative 14.
State Regulatory Requirement	Aquatic Lands	Aquatic Lands Management - Washington State [RCW 79.90; Chapter 332-30 WAC].	Relevant and Appropriate	The Aquatic Lands Management law develops criteria for managing state-owned aquatic lands. Aquatic lands are to be managed to promote uses and protect resources as specified in the regulations. The criteria in the Aquatic Lands Management law are relevant and appropriate to remedial actions involving Railroad and/or Copper Creeks under MTCA.	The Selected Remedy will comply with these regulations through source control measures and monitoring. The particular provisions that are relevant and appropriate will be identified through the remedial design.	Alternative 11M would comply with the regulatory requirement by environmental cleanup and future protection of the creeks from recontamination.	As discussed in ASFS Sections 6.2.2.1 and 6.2.2.2.1,, current information is not sufficient to allow the Agencies to conclude that remedial actions proposed under this alternative to address discharges from Tailings Piles 2 and 3 (including natural attenuation processes) would be sufficient to meet surface water ARARs and be protective of aquatic life in Railroad Creek.	Alternative 14 would comply with the regulatory requirement by environmental cleanup and future protection of the creeks from recontamination.

[1] MTCA is also being implemented independently by the State of Washington at the Site. In that application, Alternatives 11M and 14 satisfy MTCA's requirement that a remedy be "permanent to the maximum extent practicable" differently. Overall, Ecology has determined that while Alternative 11M is more permanent that Alternative 14 (principally by removing waste rock and impacted soil in the Honeymoon Heights Area rather than relying on in situ treatment), it would be less protective than Alternative 14 at a greater overall cost. Alternative 14 thus better satisfies the MTCA requirements than Alternative 11M because it relies on permanent solutions to the maximum extent practicable.

[2] The Alternative does not include groundwater containment to the maximum extent practicable (e.g., downgradient of Tailings Piles 2 and 3) that would avoid expansion of the plume. WAC 173-340-360(2)(c)(ii) requires containment to the maximum extent practicable to avoid lateral and vertical expansion of the groundwater volume affected by the hazardous substance. The Alternative relies on a no action approach (i.e., dilution and dispersion measured in geologic time) to protect terrestrial ecological receptors in Lower West Area, Honeymoon Heights Waste Rock Piles, DSHH, and Holden Village, when soil cleanup actions may be practicably taken in those areas.

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement	Comparison of Alternatives in Meeting ARAR Requirements		
						Alternative 11M	Alternative 13M	Alternative 14
Federal Regulatory Requirement	Sediment	Federal Water Pollution Control Act--Discharge of Dredge and Fill Materials [Clean Water Act; 33 U.S.C. § 1344, Section 404] and Implementing Regulations.	Applicable or Relevant and Appropriate	Section 404 of the CWA establishes a program to regulate the discharge of dredged and fill materials into the waters of the United States, including wetlands. The substantive provisions of this requirement are applicable or relevant and appropriate to remedial actions involving dredging, filling, diversion, and/or construction in streams or wetlands at the Site.	The particular provisions of the program that are applicable or relevant and appropriate for discrete remedial actions will be identified through the remedial design process and complied with in remedy implementation. These provisions are relevant to any work affecting wetlands, and much of the work affecting the creeks at the Site.	Requirements for discharge of dredged and fill materials into waters of the United States would be addressed and met during the design phase of Alternative 11M.	Requirements for discharge of dredged and fill materials into waters of the United States would be addressed and met during the design phase of Alternative 13M.	Requirements for discharge of dredged and fill materials into waters of the United States would be addressed and met during the design phase of Alternative 14.
Federal Regulatory Requirement	Hazardous Waste	Resource Conservation and Recovery Act [42 U.S.C. § 6901 et seq.], Subtitle C - Hazardous Waste Management [40 C.F.R. Parts 260 to 279].	Applicable or Relevant and Appropriate.	Subtitle C hazardous waste regulations specify hazardous waste identification, management, and disposal requirements. These regulations are applicable for generation, management, and disposal of hazardous waste. Where Washington has an authorized state hazardous waste program (RCW 70.105; Chapter 173-303 WAC), it applies in lieu of the federal program	The hazardous waste requirements will be complied with during implementation of the Selected Remedy if hazardous wastes are encountered (e.g., in the former Mill Building). Refer to Washington State Hazardous Waste Management Act and Dangerous Waste regulations below.	This alternative includes characterization of potential hazardous wastes in the former Mill Building.	This alternative would not include characterization of potential hazardous wastes in the former Mill Building.	This alternative includes characterization of potential hazardous wastes in the former Mill Building.
Federal Regulatory Requirement	Solid Waste	Resource Conservation and Recovery Act [42 U.S.C. § 6901 et seq.], Subtitle D - Managing Municipal and Solid Waste [40 C.F.R. Parts 257 and 258].	Relevant and Appropriate	Subtitle D of RCRA establishes a framework for management of non-hazardous solid waste. These regulations establish guidelines and criteria from which states develop solid waste regulations. Subtitle D is relevant and appropriate to solid waste disposal and management at the Site.	The particular provisions of the solid waste requirements that are relevant and appropriate will be identified and complied with during the remedial design process. During the remedial design process limited purpose landfill requirements will be identified and complied with for consolidation, regrading, and capping of the waste rock and tailings piles.	No wastes are anticipated to be moved off the Site for disposal, with the possible exception of residual processing wastes that may be designated as state Dangerous Wastes or asbestos encountered during cleanup of the former Mill Building. On-site management of non-hazardous solid waste would be addressed during the design phase of the remedy implementation.	No wastes are anticipated to be moved off the Site for disposal under this alternative. On-site management of non-hazardous solid waste would be addressed during the design phase of the remedy implementation.	No wastes are anticipated to be moved off the Site for disposal, with the possible exception of residual processing wastes that may be designated as state Dangerous Wastes or asbestos encountered during cleanup of the former Mill Building. The on-site management of non-hazardous solid waste would be addressed during the design phase of the remedy implementation.
State Regulatory Requirement	Solid Waste	Washington State Solid Waste Handling Standards [RCW 70.95; Chapter 173-350 WAC].	Applicable or Relevant and Appropriate	Washington State Solid Waste Handling Standards apply to facilities and activities that manage solid waste. The regulations set minimum functional performance standards for proper handling and disposal of solid waste; describe responsibilities of various entities; and stipulate requirements for solid waste handling facility location, design, construction, operation, and closure. Particular to the Site, tailings and waste rock pile operations ceased prior to enactment of the Solid Waste Management Act, Chapter 70.95 RCW, and before the effective date of Chapter 173-350 WAC, and the tailings and waste rock piles are not currently being operated as limited purpose landfills. However, all substantive requirements for closure and post-closure of limited purpose landfills [WAC 173-350-400] are ARARs [WAC 173-340-710(7)(c)]. The tailings and waste rock piles at the Site are landfills that contain solid waste and are releasing hazardous substances above both state and federal cleanup standards. This regulation is also applicable for management of excavated soil, soil-like material, and debris that will be generated during the Site cleanup. The regulation is applicable to the proposed limited purpose landfill that will be constructed at the Site for disposal of the sludge that will be produced during long-term groundwater treatment operations.	The Selected Remedy will comply with Solid Waste Handling Standards. The particular portions of the selected remedy to which this ARAR is applicable or relevant and appropriate will be identified through the remedial design process. Compliance with these standards will include requirements for closure and post-closure of limited purpose landfills on the Site, or the tailings piles and waste rock piles, consolidation of contaminated site areas such as mill building and pond sediments on the tailings piles, and design and location of a sludge treatment pond.	Under Alternative 11M, the closure of the tailings and waste rock piles would conform to state landfill regulations and other ARARs. This would reduce the risk of exposure to humans and terrestrial ecological receptors.	Alternative 13M would not meet the Limited Purpose Landfill closure requirements. Information presented for Alternative 13M does not show that the 6-inch cover of soil/gravel and wood slash proposed for the tailings and waste rock piles [or the 12-inch cover discussed in URS (2010a)] would satisfy the performance requirements for closure of Limited Purpose Landfills, WAC 173-350-400.	Under Alternative 14, the closure of the tailings and waste rock piles would conform to state landfill regulations and other ARARs. This would reduce the risk of exposure to humans and terrestrial ecological receptors.

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement	Comparison of Alternatives in Meeting ARAR Requirements: Alternative 11M	Alternative 13M	Alternative 14
State Regulatory Requirement	Hazardous Waste	Washington State Hazardous Waste Management Act and Dangerous Waste Regulations [RCW 70.105; Chapter 173-303 WAC].	Applicable or Relevant and Appropriate	Washington State Dangerous Waste regulations govern the handling and disposition of dangerous waste, including identification, accumulation, storage, transport, treatment, and disposal. Washington State has not adopted an exemption for certain mining wastes (such as the Bevill Amendment) from regulation under RCRA Subtitle C*. * Washington did adopt a limited exemption from the Dangerous Waste regulations for mining overburden returned to the Site. However, overburden is defined as a material used for reclaiming a surface mine and is not a discarded material within the scope of RCRA (45 FR 33000; May 19, 1980, and 67 FR 63060; October 10, 2002).	The Selected Remedy will comply with dangerous waste regulations. The particular portions of the selected remedy to which this ARAR are applicable or relevant and appropriate will be identified through the remedial design process. The hazardous waste requirements will be complied with during implementation of the Selected Remedy (e.g., in the former Mill Building).	This Alternative includes characterization of potential hazardous wastes in the former Mill Building. No wastes are anticipated to be moved off the Site for disposal, with the possible exception of residual processing wastes that may be designated as state Dangerous Waste, or asbestos encountered during cleanup of the former Mill Building.	This Alternative would not include characterization of potential hazardous wastes in the former Mill Building. No wastes are anticipated to be moved off the Site for disposal.	This Alternative includes characterization of potential hazardous wastes in the former Mill Building. No wastes are anticipated to be moved off the Site for disposal, with the possible exception of residual processing wastes that may be designated as state Dangerous Waste, or asbestos encountered during cleanup of the former Mill Building.
State Regulatory Requirement	Requirement Not Media Specific	Maximum Environmental Noise Levels - Washington State [RCW 70.107; Chapter 173-60 WAC].	Applicable	The Maximum Environmental Noise Levels regulations of Washington State establish maximum noise levels permissible in identified environments, and provide use standards relating to the reception of noise within these environments. These regulations are applicable depending on the remedial activities selected for the Site.	The particular portions of the Selected Remedy to which this ARAR is applicable will be identified and complied with through the remedial design process.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.
Federal Regulatory Requirement	Air	Clean Air Act [42 U.S.C. § 7401 et. seq.; 40 C.F.R. Part 50].	Applicable	The federal Clean Air Act creates a national framework designed to protect ambient air quality by limiting air emissions. These regulations are applicable to construction activities at the Site.	The particular portions of the Selected Remedy to which this ARAR is applicable will be identified and complied with through the remedial design process and prior to construction activities at the Site.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.
State Regulatory Requirement	Air	Washington Clean Air Act and Implementing Regulations [WAC 173-400-040(8)].	Applicable	This regulation is applicable to remedial actions at the Site. It requires the owner or operator of a source of fugitive dust to take reasonable precautions to prevent fugitive dust from becoming airborne and to maintain and operate the source to minimize emissions.	The particular portions of the Selected Remedy to which this ARAR is applicable will be identified and complied with through the remedial design process and implemented during construction activities at the Site.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.
State Regulatory Requirement	Air	General Regulations for Air Pollution Sources - Washington State [RCW 70.94; Chapter 173-400 WAC].	Applicable	These regulations provide for the systematic control of air pollution from air contaminant sources and for the proper development of the state's natural resources. The purpose of the regulations is to establish technically feasible and reasonably attainable standards, and to establish rules generally applicable to the control and/or prevention of the emission of air contaminants. Depending on the remedial action selected, these regulations are applicable to the Site (e.g., generation of fugitive dust during remediation of soil and tailings, or emissions from equipment).	The particular portions of the Selected Remedy to which this ARAR is applicable will be identified and complied with through the remedial design process and implemented during construction activities at the Site.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.
Federal Regulatory Requirement	Air	National Emissions Standards for Hazardous Air Pollutants (NESHAP) - Asbestos, 40 C.F.R. Part 61, Subpart M.	Applicable	Demolition or removal of any asbestos-containing materials in the former Mill Building must comply with NESHAP requirements.	The particular portions of the Selected Remedy to which this ARAR is applicable will be identified and complied with through the remedial design process and implemented during construction activities at the Site.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.
State Regulatory Requirement	Groundwater	Regulation and Licensing of Well Contractors and Operators [RCW 18.104; Chapter 173-162 WAC].	Applicable	These regulations establish procedures for the examination, licensing, and regulation of well contractors and operators. "Well" means water wells, resources protection wells, instrumentation wells, dewatering wells, and geotechnical soil borings. These requirements are applicable to contractors who install and/or decommission wells and borings at the Site.	The Selected Remedy will comply with the substantive requirements of these regulations for contractors who install and/or decommission wells and borings. The particular portions of the selected remedy to which this ARAR is applicable will be identified through the remedy design process, including any identified future site investigation activity.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.
State Regulatory Requirement	Groundwater	Minimum Standards for Construction and Maintenance of Water Wells [RCW 18.104; Chapter 173-160 WAC].	Applicable	Washington State has developed minimum standards for constructing water and monitoring wells, and for the decommissioning of wells. These standards are applicable to wells constructed at the Site for water withdrawal or monitoring, and for decommissioning of Site wells.	The Selected Remedy will comply with the substantive requirements of the applicable regulation. The particular portions of the selected remedy to which this ARAR is applicable will be identified through the remedy design process, including any identified future site investigation activity.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.

Table 17 – Action-Specific ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement	Comparison of Alternatives in Meeting ARAR Requirements		
						Alternative 11M	Alternative 13M	Alternative 14
State Regulatory Requirement	Requirement Not Media Specific	Submission of Plans and Reports for Construction of Wastewater Treatment Facilities in Washington State [RCW 90.48; Chapter 173-240 WAC].	Applicable	The regulations also include provisions for review and approval of proposed methods for operation and maintenance, and for construction modifications. Substantive aspects of these requirements are applicable to the Site since the remedial action involves construction of a wastewater treatment system.	The particular portions of the Selected Remedy to which this regulation is applicable, will be identified and complied with through the remedial design process.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.	The Alternative would comply with the regulatory requirement during the design and construction phases of the remedy.

Table 18 – Location-Specific ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Federal Regulatory Requirement	Surface Water	Clean Water Act (CWA), Section 404 [33 U.S.C. 1344, 40 C.F.R. Part 230, 33 C.F.R. §§ 320-330 332]	Applicable or Relevant and Appropriate	Section 404 of the CWA establishes a program to regulate the discharge of dredged and fill materials into the waters of the United States, including wetlands. The substantive provisions of this requirement are applicable or relevant and appropriate to remedial actions involving dredging, filling, diversion, and/or construction in streams or wetlands at the Site.	The particular provisions of the program that are applicable for discrete remedial actions will be identified through the remedial design process and complied with in remedy implementation. These provisions are relevant and appropriate to any work affecting wetlands, and much of the work affecting the creeks at the Site
Federal Regulatory Requirement	All National Forest System Lands	National Forest Management Act [16 U.S.C. §§ 1600 – 1614] (NFMA) and Land and Implementing Regulation and Resource Management Plan for Wenatchee National Forest (LRMP, Forest Service 1990), as Amended by Pacific Northwest Forest Plan (NWFP, 1994) and subsequent amendments of the NWFP (2001, 2004 and 2007)	Applicable or Relevant and Appropriate	The Wenatchee National Forest LRMP, as amended by the Pacific Northwest Forest Plan, contains standards and guidelines (S&G) for all actions to be taken on National Forest System lands within the Forest boundaries. All remedy components and all materials developed for the remedy or lands disturbed for any portion of the remedy will follow the applicable and relevant and appropriate standards and guidelines set forth in the LRMP. The S&G ARARs would be for the following Management Areas as defined in the Wenatchee NF LRMP. Management areas at the Site are as follows: Scenic Travel – Retention ST-1; Dispersed Recreation, Unroaded Non-motorized RE-3; Matrix; Late Successional Reserve; Administratively Withdrawn. Examples of S&G ARARs include RF-2 through RF-7, which control the design, construction, and use of temporary and permanent roads and other modifications within Riparian Reserves (applicable); and MM-3, which controls solid waste and mine waste facilities within Riparian Reserves (relevant and appropriate).	The S&G ARARs for particular portions of the Selected Remedy would be identified and complied with through the remedial design process and implemented during construction activities at the Site.

Table 18 – Location-Specific ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Federal Regulatory Requirement	Historic Buildings	National Historic Preservation Act [16 U.S.C. § 470] and Implementing Regulations	Applicable	The National Historic Preservation Act (NHPA) requires federal agencies to take into account the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places (NRHP) or as a National Historic Landmark. Depending on the remedial actions selected for the Site and, in particular, determination of the need for demolition of the abandoned mill building, NHPA requirements are applicable and would need to be addressed during remedial design.	The ROD at Section 12.4 and Appendix A outlines the substantive actions addressing NHPA requirements, and establishes a process to address further NHPA issues that may arise during remedial design or remedial action.
Federal Regulatory Requirement	Historic Buildings	Historic Site, Buildings, Objects, and Antiquities Act [16 U.S.C. §§ 461 - 467] and Implementing Regulations	Applicable	The Historic Site, Buildings, Objects, and Antiquities establishes as a policy the preservation of historic sites, buildings, and objects of national significance. This Act is applicable where components of the Site listed or eligible for listing on the Historic Site, Buildings, Objects and Antiquities Federal Register would be impacted by remedial actions.	The particular portions of the Selected Remedy to which this ARAR is applicable would be identified and complied with through the remedial design process.
Federal Regulatory Requirement	Archaeological Resources	Archaeological and Historic Preservation Act [16 U.S.C. § 469] and Implementing Regulations	Applicable	The Archaeological and Historic Preservation Act (AHPA) provides for the preservation of archaeological and historic data that might be destroyed through alteration of terrain during a federal construction project or a federally licensed program or activity. This Act is applicable to the Site where remedial activities would cause loss or adverse impacts to significant scientific, prehistoric, historic, or archaeological data.	The particular portions of the Selected Remedy to which this ARAR is applicable would be identified and complied with through the remedial design process.
Federal Regulatory Requirement	Archaeological Resources	Archaeological Resources Protection Act [16 U.S.C. § 470] and Implementing Regulations	Applicable	The Archaeological Resources Protection Act prescribes the steps that must be taken by investigators to preserve archaeological resources. This Act is applicable to the Site where remedial activities would cause loss or adverse impacts to significant scientific, prehistoric, historic, or archaeological data.	The particular portions of the Selected Remedy to which this ARAR is applicable would be identified and complied with through the remedial design process.

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Federal Regulatory Requirement	Native American Burial Grounds	Native American Graves Protection and Reparation Act [25 U.S.C. § 3001 et seq] and Implementing Regulations	Applicable	The Native American Graves Protection and Reparation Act protects the remains, funerary objects, and cultural artifacts of Native Americans. The requirements of this Act must be followed when graves are discovered or ground-disturbing activities encounter Native American burial sites. This Act is applicable to the Site where remedial actions involve disturbance/alteration of the ground and/or site terrain.	The particular portions of the Selected Remedy to which this ARAR is applicable would be identified and complied with through the remedial design process.
Federal Regulatory Requirement	Stream and Sediment	Fish and Wildlife Conservation Act [16 U.S.C. §§ 2901 - 2911] and Implementing Regulations	Applicable	The purpose of the Fish and Wildlife Conservation Act is to promote conservation of non-game fish and wildlife through assistance to states and use of federal authority. The requirements of this Act are applicable to Site remedial activities, including action in Railroad Creek and Copper Creek involving stream diversion, dredging, and/or channel altering activities.	The particular portions of the Selected Remedy to which this ARAR is applicable would be identified and complied with through the remedial design process.
Federal Regulatory Requirement	Stream and Sediment	Fish and Wildlife Coordination Act [16 U.S.C. §§ 661-667] and Implementing Regulations	Applicable	The Fish and Wildlife Coordination Act provides that when the waters or channel of a body of water are modified by a federal entity, the department or agency must first consult with the US Fish and Wildlife Service (USFWS) and with the head of the agency exercising administration over the wildlife resources of the state (WSDFW), with a view to the conservation of wildlife resources. The requirements of this Act are applicable to the Site where the implementation of remedial activities involves impacts to water or stream channels.	The substantive requirements of the Fish and Wildlife Coordination Act that are applicable to the Selected Remedy would be identified and complied with through the remedial design process. Consultation with USFWS and WSDFW would be conducted during the design phase. Impacts to water or the stream channel would be monitored during remedy implementation.

Table 18 – Location-Specific ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Federal Regulatory Requirement	Aquatic and Terrestrial Fish, Wildlife, and Plants	Endangered Species Act [16 U.S.C. §§ 1531 - 1544] and Implementing Regulations	Applicable	The Endangered Species Act (ESA) protects species of fish, wildlife, and plants that are listed as threatened or endangered with extinction. It also protects designated critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species, including consultation with resource agencies. The requirements of the ESA are applicable to the Site since listed threatened or endangered species habitat areas would, or could, be impacted by remedial action. Section 7 consultation was completed on April 13, 2011 for all T&E species that "may be affected, but are not likely to be adversely affected" by the project. Consultation included conservation measures and conditions for reinitiation of consultation for portions of the project that were insufficiently described to determine effect, or for changes in proposed project activities. Additionally, Section 7 consultation was completed, and a Biological Opinion (BO) issued on June 14, 2011, for the northern spotted owl, a threatened species for which adverse effects are anticipated as a result of the project. The BO includes reasonable and prudent measures, terms and conditions, reporting requirements, and conservation recommendations to minimize adverse effects.. The Railroad Creek valley has historically provided habitat to spotted owls, lynx, grizzly bears, gray wolves, and other potentially threatened or endangered species. These species may occur within or adjacent to the Site as recovery of the species and/or the habitat progress. Consistent with ESA Section 7, if any federally designated threatened or endangered species are identified in the vicinity of remediation work, and the action may affect such species and/or their habitat, the Agencies would consult with USFWS to ensure that remedial actions are conducted in a manner to avoid adverse habitat modification and jeopardy to the continued existence of such species.	The particular portions of the Selected Remedy to which this ARAR is applicable(as identified through Section 7 consultation), would be identified and complied with through the remedial design process. Requirements could include conservation measures, conditions for reinitiation of consultation, implementation of reasonable and prudent measures, implementation of terms and conditions, compliance with USFWS and WSDFW reporting requirements, and conservation recommendations.

Table 18 – Location-Specific ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Federal Regulatory Requirement	Requirement Not Media Specific	Wilderness Act [16 U.S.C. §§ 1131 - 1136] and Implementing Regulations	Applicable	The Wilderness Act established the National Wilderness Preservation System, which is to be comprised of federal land designated by Congress as wilderness areas, and administered to leave the land unimpaired for future use as a wilderness. The Site is bordered on three sides by the Glacier Peak Wilderness. Although the Selected Remedy does not contemplate activities in the Wilderness, any activities that might indirectly impact the Wilderness would be identified and would need to comply with Wilderness Act requirements.	The particular portions of the Selected Remedy to which this ARAR is applicable be identified and complied with through the remedial design process.
Federal Regulatory Requirement	Wetlands	Executive Order 11990 - Protection of Wetlands	Applicable	Executive Order 11990 requires that potential impacts to wetlands be considered, and as practical, destruction, loss, or degradation of wetlands be avoided. EPA promulgated regulations to implement this Executive Order under 40 C.F.R. Part 6. The requirements of this Order are applicable to remedial activities that take place within Railroad and Copper Creeks and Site wetlands.	The particular portions of the Selected Remedy to which this ARAR is applicable would be identified and complied with through the remedial design process.
Federal Regulatory Requirement	Floodplains	Executive Order 11988 - Protection of Floodplains	Applicable	Executive Order 11988 requires evaluation of the potential effects of actions that take place in a floodplain to avoid, to the extent possible, adverse impacts. EPA promulgated regulations to implement this Executive Order under 40 C.F.R. Part 6. The requirements of this Order are applicable to remedial activities that take place within the 100-year floodplain of Railroad and Copper Creeks.	The particular portions of the Selected Remedy to which this ARAR is applicablewould be identified and complied with through the remedial design process.
Federal Regulatory Requirement	Native American	The American Indian Religious Freedom Act [AIRFA; 42 U.S.C. § 1996] and Implementing Regulations	Applicable	This Act mandates federal agencies to protect the right of Indian Tribes to exercise their traditional religions. It is applicable to land-disturbing activities implemented during remedial action if places and physical paraphernalia needed for religious practice are affected. This Act is applicable to the Site if traditional cultural properties, archaeological resources, or historic sites important to the practice of American Indian religions are present.	The particular portions of the Selected Remedy to which this ARAR is applicable would be identified and complied with through the remedial design process.

Table 18 – Location-Specific ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Federal Regulatory Requirement	Requirement Not Media Specific	Migratory Bird Treaty Act (MBTA), 16 U.S.C. § 703 et seq and Implementing Regulations	Applicable	The MBTA makes it unlawful to "hunt, take, capture, kill" or take various other actions adversely affecting a broad range of migratory birds, including tundra swans, hawks, falcons, songbirds, without prior approval by the USFWS. (See 50 C.F.R. 10.13 for the list of birds protected under the MBTA.) Under the MBTA, permits may be issued for take (e.g., for research) or killing of migratory birds (e.g., hunting licenses). The mortality of migratory birds due to ingestion of contaminated media (soil, sediment, water, etc.) is not a permitted take under the MBTA. The MBTA and its implementing regulations are relevant and appropriate for protecting migratory bird species identified.	The Selected Remedy would be carried out in a manner that avoids the taking or killing of protected migratory bird species, including individual birds or their nests or eggs.
Federal Regulatory Requirement	Roads	Roadless Area Conservation Rule 2001 [66 Fed. Reg. 3244, January 12, 2001]	Applicable	This rule limits road construction, reconstruction, and timber harvest in inventoried roadless areas because they have the greatest likelihood of altering and fragmenting landscapes, resulting in immediate, long-term loss of roadless area values and characteristics. This rule is applicable to permanent roads and temporary construction roads in the vicinity of the Site.	The particular portions of the Selected Remedy to which this ARAR is applicable would be identified and complied with through the remedial design process.

Note: The ARARs identified in this table would be addressed during the design and construction phases of remedy implementation for Alternatives 11M, 13M, and 14.

Table 19 - TBC Criteria for the Selected Remedy

Authority	Medium/ Remedial Component	TBC Reference	Synopsis of TBC	Action to be Taken to Address TBC
Federal	Requirement Not Media Specific	Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management.	This order establishes a policy that federal agencies conduct their activities in an environmentally sound and sustainable manner.	The Selected Remedy will include conducting remedial actions in an environmentally sound and sustainable manner.
Federal	Requirement Not Media Specific	Superfund Remedial Design and Remedial Action Guidance [EPA OSWER Directive 9355.0-4A, June 1986]	This guidance is a TBC for the remedial design and remedial action components of the Site remediation. The document provides guidance on such things as design initiation, reviews, compliance with permitting requirements, and community relations.	The Selected Remedy will address this TBC.
State	Wastewater Discharge	Permit Writer's Manual (Department of Ecology, Publication 92-109, Rev. July 2002).	The Permit Writer's Manual is a technical guidance and policy manual for permit writers who develop wastewater discharge permits in Washington State. For the Site, the manual is a TBC for the remedial selection process. This consideration will include, but not be limited to, evaluation of discharge limits, AKART, and mixing zones.	The Selected Remedy will address this TBC as it pertains to the wastewater treatment facility design and construction phases of remedy implementation.
Federal	Requirement Not Media Specific	Superfund Green Remediation Strategy, Office of Superfund Remediation and Technology Innovation, August 2009.	This sets out the plans of the Superfund Remedial Program to reduce greenhouse gas emissions and other negative environmental impacts that might occur during remediation of a hazardous waste site.	The Selected Remedy will address this TBC.
Federal	Cleanup Footprint	Incorporating Sustainable Practices into Remediation of Contaminated Sites, April, 2008, EPA 542-R-08-002.	This outlines the principles of green remediation and describes opportunities to reduce the footprint of cleanup activities throughout the life of a project.	The Selected Remedy will address this TBC.
Federal	Cleanup Footprint	EPA's Principles for Greener Cleanups, August 27, 2009.	This sets forth the goal to evaluate cleanup actions comprehensively to ensure protection of human health and the environment and to reduce the environmental footprint of cleanup activities, to the maximum extent possible.	The Selected Remedy will address this TBC.

Table 19 - TBC Criteria for the Selected Remedy

Authority	Medium/ Remedial Component	TBC Reference	Synopsis of TBC	Action to be Taken to Address TBC
Federal	Historic Properties	Executive Order 11593 - Protection and Enhancement of the Cultural Environment	Executive Order 11593 directs federal agencies to nominate historic properties to the National Register of Historic Places (NRHP) and to treat properties eligible for the NRHP as though they were listed under the National Historic Preservation Act (16 USC § 470). The requirement is potentially applicable to land-disturbing activities implemented during remedial action if archaeological resources or sites are present or encountered.	The executive order will be addressed during the design and implementation on the Selected Remedy.
Federal	Indian Sacred Grounds	Executive Order 13007 - Indian Sacred Sites	Executive Order 13007 requires federal agencies to avoid physical damage to Indian sacred sites and to avoid interfering with access to such sites. The requirement is potentially applicable to land-disturbing activities implemented during remedial action if archaeological resources or sites are present or encountered. The requirements of this Order are potentially “to be considered” for the Site if Indian archaeological resources or historic sites are present.	The executive order will be addressed during the design and implementation on the Selected Remedy.
Federal	Requirement Not Media Specific	Executive Order 13112 - Invasive Species	Executive Order 13112 requires federal agencies to prevent the introduction of invasive species and not authorize, fund, or carry out action believed to be likely to cause or promote the introduction or spread of invasive species, unless the benefits of such actions clearly outweigh the potential harm caused by invasive species and actions are taken to minimize harm. This Order is “to be considered” for persons and equipment used during implementation of remedial actions to ensure invasive species are not introduced to the Site. Executive Order 13112 also includes direction regarding the use of native species for restoration. This Order is also “to be considered” for design and implementation of remedial components involving site restoration.	The executive order will be addressed during the design and implementation on the Selected Remedy.
Federal	Requirement Not Media Specific	Executive Order 13186 - Responsibilities of Federal Agencies to Protect Migratory Birds	Executive Order 13186 requires federal agencies avoid or minimize adverse impacts to migratory bird resources, restore and enhance migratory bird habitat, and prevent or abate pollution or detrimental alteration of the environment for the benefit of migratory birds to the extents practicable. This Order is “to be considered” for the remedial actions at the Site.	The executive order will be addressed during the design and implementation on the Selected Remedy.

Table 19 - TBC Criteria for the Selected Remedy

Authority	Medium/ Remedial Component	TBC Reference	Synopsis of TBC	Action to be Taken to Address TBC
State	Dam Safety	Dam Safety Guidelines Part 4-Dam Design and Construction (Department of Ecology, Publication 92-55d, July 1993)	Guidelines developed by the Washington State Department of Ecology Dam Safety Office (DSO) as required under WAC 173-175-050 are a potential TBC based on DSO jurisdictional interpretations regarding the tailings piles at the Site.	These guidelines will be addressed during the design and implementation of the Selected Remedy.
Federal	Requirement Not Media Specific	Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance, October 5, 2009	This establishes reduction of greenhouse gas emissions as a priority for federal agencies. The order indicates that as a matter of policy the federal government "must lead by example" in increasing energy efficiency, reducing greenhouse gas emissions, etc.	For the particular portions of the Selected Remedy to which this TBC is relevant, consideration will be given to the reduction in greenhouse gases through the remedial design and implementation process.
Federal	Requirement Not Media Specific	EPA Region 10's Clean and Green Policy, August 13, 2009.	EPA Region 10's Clean and Green Policy applies to all Superfund cleanups including those performed by Potentially Responsible Parties (PRPs) The Policy encourages cleanup practices that, among other things, employ 100% use of renewable energy, and energy conservation and efficiency approaches including EnergyStar equipment; and use of cleaner fuels and diesel emissions controls.	For the particular portions of the Selected Remedy to which this TBC is relevant, consideration will be given to the elements of the Clean and Green Policy through the remedial design and implementation process.
Federal	Groundwater	Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration, OSWER Directive 9283.	This Directive provides a compilation of some key existing EPA groundwater policies relevant to the remedial action at the Siteparticularly in relation to groundwater restoration and consistency with CERCLA and the NCP.	For the particular portions of the Selected Remedy to which this TBC is relevant, consideration will be given to these policies through the remedial design and implementation process.
Federal	Landfill Caps	Revegetating Landfills and Waste Containment Areas Fact Sheet, EPA 542-F-06-001	The Agencies have identified EPA guidance on native plants and invasive species as potential TBCs	The design, construction and maintenance of caps (e.g., on the Tailings Piles) in the Selected Remedy will address EPA revegetation guidance.

Table 19 - TBC Criteria for the Selected Remedy

Authority	Medium/ Remedial Component	TBC Reference	Synopsis of TBC	Action to be Taken to Address TBC
Federal	Revegetation	Frequently Asked Questions About Ecological Revitalization of Superfund Sites, EPA 542-F-06-002	The Agencies have identified EPA guidance on native plants and invasive species as potential TBCs	The Selected Remedy will address EPA revegetation guidance during remedial design, construction, and maintenance of the selected remedy.
Federal	Native Plants and Invasive Species	Ecological Revitalization and Attractive Nuisance Issues EPA 542-F-06-003	The Agencies have identified EPA guidance on native plants and invasive species as potential TBCs	The Selected Remedy will address EPA guidance during remedial design, construction, and maintenance of the selected remedy.
State	Sediment	Ecology's Freshwater Sediment Guidelines (Ecology 2011)	The State's freshwater sediment guidelines (Development of Benthic SQVs for Freshwater Sediments in Washington, Oregon, and Idaho) provide numeric criteria for freshwater sediments in the Northwest. .	The Selected Remedy will take into consideration the numeric criteria in these guidelines in conjunction with other measures of sediment quality such as bioassays..
Federal	Wetlands	EPA Wetland Guidance documents at http://water.epa.gov/lawsregs/guidance/wetlands/wetlandsmitigation_index.cfm#regs	These documents provide updates and background information regarding compensatory mitigation requirements for wetlands	These guidelines will be addressed during the design and implementation of the Selected Remedy.
State	Wetlands	Ecology Wetland Guidance documents at http://www.ecy.wa.gov/mitigation/guidance.html	These documents provide updates and background information regarding compensatory mitigation requirements for wetlands	These guidelines will be addressed during the design and implementation of the Selected Remedy.

Note: The TBCs identified in this table would be addressed during the design and construction phases of remedy implementation for Alternatives 11M, 13M, and 14.

Table 20 - Points of Compliance

Media	Points of Compliance (a)
Soil	Under MTCA, soil cleanup levels and points of compliance are established separately for human exposure via direct contact, the protection of groundwater, and the protection of terrestrial ecological receptors [WAC 173-340-740]. The MTCA point of compliance for soil based on human exposure via direct contact is from the surface of the soil to 15 feet below the ground surface. However, capping and/or institutional controls will be established at various locations at the Site to prohibit excavation and other activities to eliminate the direct contact exposure pathway for humans. A point of compliance for soils will be established based on risk to terrestrial ecological receptors. This point of compliance will be the biologically active zone, which is assumed to extend to a depth of 6 feet, or a site-specific depth based on a demonstration that an alternative depth is appropriate per WAC 173-340-7490(4)(a). Soil cleanup to protect downgradient groundwater, surface water, and sediment is required wherever soils exceed criteria and are not within a groundwater containment area [WAC 173-340-740(1)(d)].
Surface Water	The point of compliance for surface water cleanup levels is the point or points where the release enters the surface waters, unless Ecology has authorized a mixing zone [WAC 173-340-730(6)]. MTCA does not allow a mixing zone for groundwater discharges into surface water [WAC 173-340-720(8)(d)(i)(C)].
Groundwater	CERCLA and the NCP provide that groundwater should be returned to its beneficial use within a reasonable time frame whenever practicable. When restoration of groundwater is not practicable, it is necessary to prevent further migration of the plume and to prevent exposure to the contaminated groundwater [40 CFR 300.430(a)(2)]. The NCP provides that groundwater cleanup levels should generally be attained throughout the contaminated plume. However, the NCP recognizes that groundwater may remain contaminated within a waste management area, and groundwater cleanup levels attained at and beyond the edge of the waste management area (55 Fed Reg 8712, 8753, March 8, 1990). MTCA requires the point of compliance for groundwater be throughout the Site, from the uppermost level of the saturated zone to the lowest depth that could potentially be affected. MTCA requires that groundwater cleanup levels be attained in all groundwater from the point of compliance to the outer boundary of the hazardous substance plume [WAC 173-340-720(8)]. MTCA allows a conditional point of compliance for groundwater for limited circumstances where it is not practicable to meet the cleanup level throughout the site within a reasonable restoration time frame (see note b). MTCA allows approval of a conditional point of compliance as close as practicable to the source of hazardous substances [WAC 173-340-720(8)(c)] and not to exceed a point located within surface water as close as technically possible to the point or points where groundwater flows into surface water [WAC 173-340-720(8)(d)(i)]. MTCA does not allow a mixing zone for groundwater discharges into surface water [WAC 173-340-720(8)(d)(i)(C)].

Notes:

(a) Points of compliance refer to the locations at the Site where cleanup levels must be met.

(b) The DFFS found that it is not practicable to meet the groundwater cleanup levels throughout the Site within a reasonable restoration time frame.

Table 23 - Cost Breakdown for the Selected Remedy

CAPITAL COSTS	
Item	**Cost**
Direct Construction Costs	
Job Setup and Construction Infrastructure	$8,340,000
Upgradient Diversions and Access Roads	$270,000
Mine, Mill, Maintenance Yard Site Remediation	$3,370,000
Groundwater Containment, Collection, and Conveyance	
West Area (LWA and TP-10)	$5,340,000
East Area (TP-2 and TP-3)	$6,690,000
Waste Rock Piles	$1,420,000
Tailings Piles	
Regrade and Cap	$4,320,000
Toe Buttress	$3,200,000
Groundwater Treatment Facilities	
East Area	$2,250,000
West Area	$910,000
Landfills	$6,280,000
Lagoon Area / SRA / Ballfield / LWA	$850,000
Surface Water Remediation	
Railroad Creek Realignment	$9,010,000
Copper Creek	$820,000
Other Surface Water Related	$240,000
In Situ Soil Treatment	$830,000
Subtotal Direct Construction Costs	$54,190,000
Contractor Markups	$10,840,000
Total Construction Costs (2005 Dollars)	$65,010,000
Non-Construction Capital Costs	$11,240,000
TOTAL CAPITAL COSTS	$76,250,000
PRESENT WORTH OF POST-CONSTRUCTION OMM COSTS	$30,750,000
TOTAL ESTIMATED COST	$107,000,000

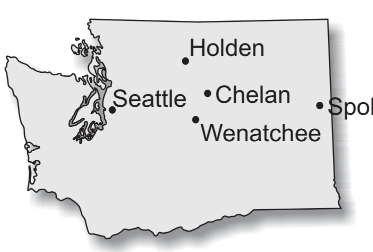
General Notes:

1. Costs shown are based on Alternative 14 and are presented in 2010 dollars, rounded as discussed in the final Feasibility Study.

Site Location and Project Vicinity Map

476916ROD-AA.cdr EAL 12/15/11

Note: Base map prepared from Microsoft Streets and Trips 2005.



WASHINGTON

N

0 7.5 15

Approximate Scale in Miles

HARTCROWSER

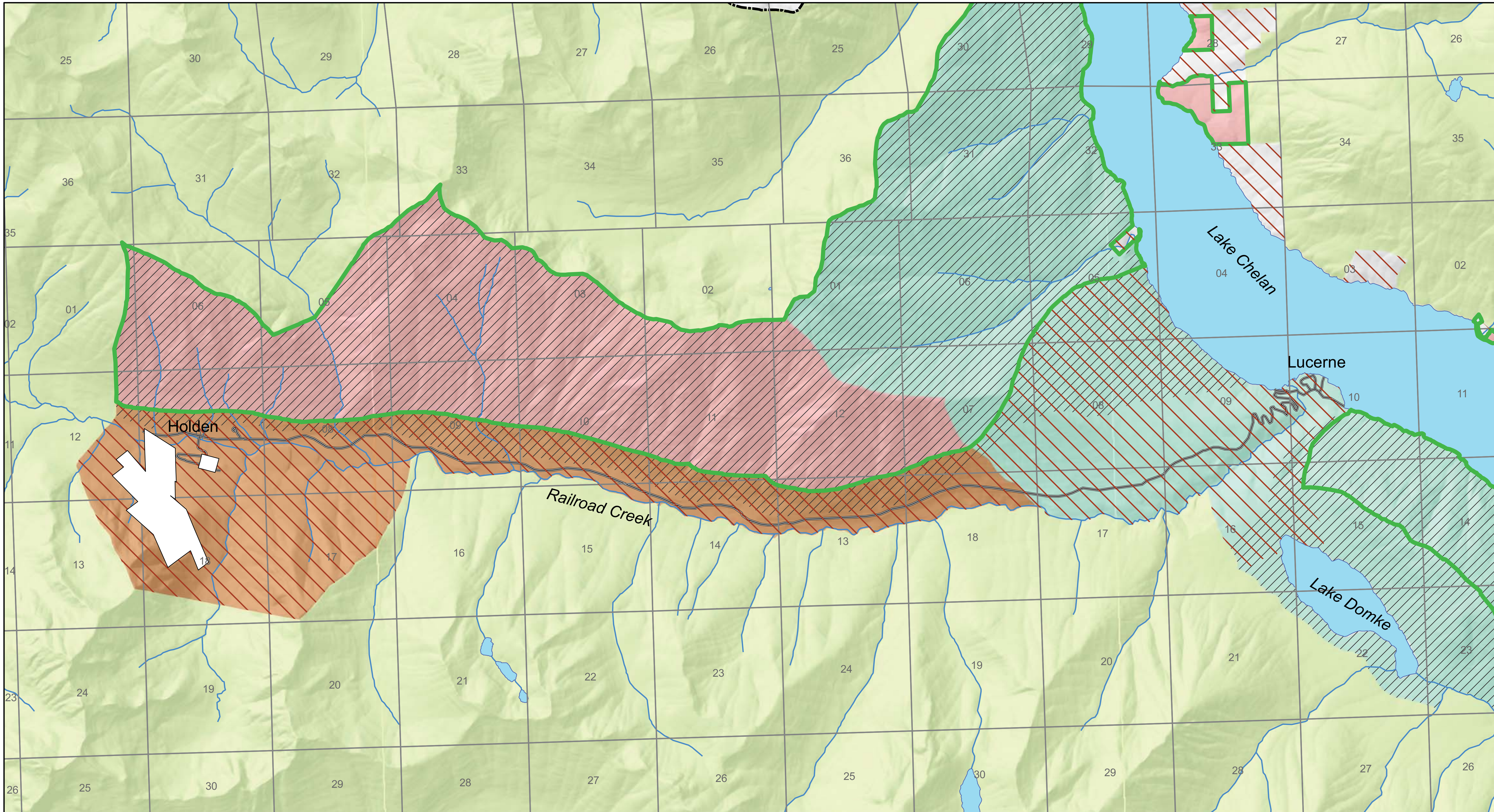
4769-16 ***12/11***

Figure 1

ROD

Land Use Map

Northwest Forest Plan Management Areas and Allocations for Holden Mine Area



Administratively Withdrawn

Congressionally Withdrawn (Glacier Peak Wilderness Area)

Late Successional Reserve (LSR)

Matrix

Private and Other (Including Patented Mining and Mill SIte Claims owned by Holden Village)

Roadless Area

Dispersed Recreation, Unroaded, Non-Motorized (RE-3)

Scenic Travel - Retention (ST-1)

Note: Matrix area includes other areas administratively withdrawn from mineral entry.

Source: Prepared from Figure 2 of ASFS, 2010.

0 4,000 8,000 Feet

N

HARTCROWSER

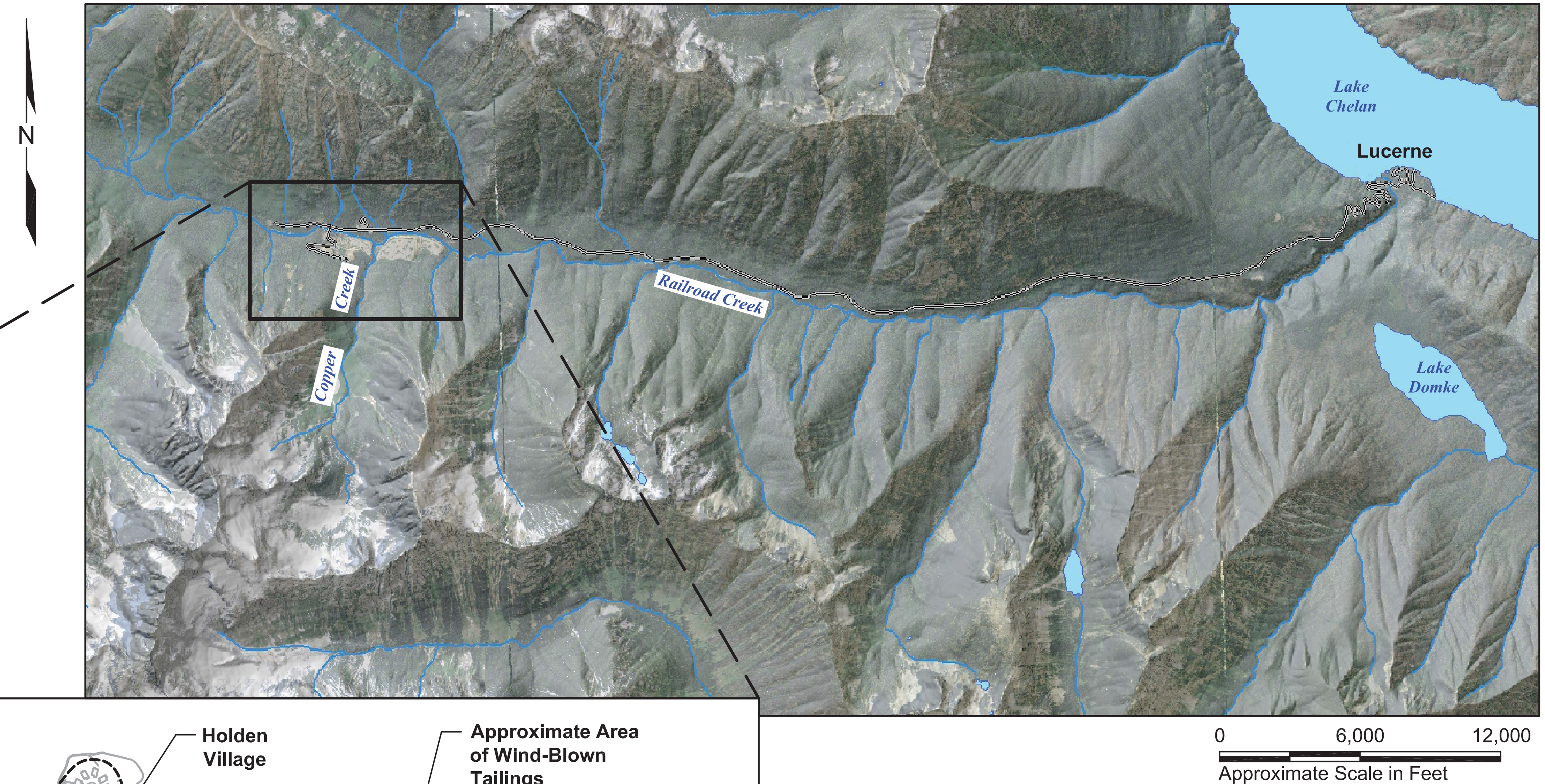
4769-16 *12/11*

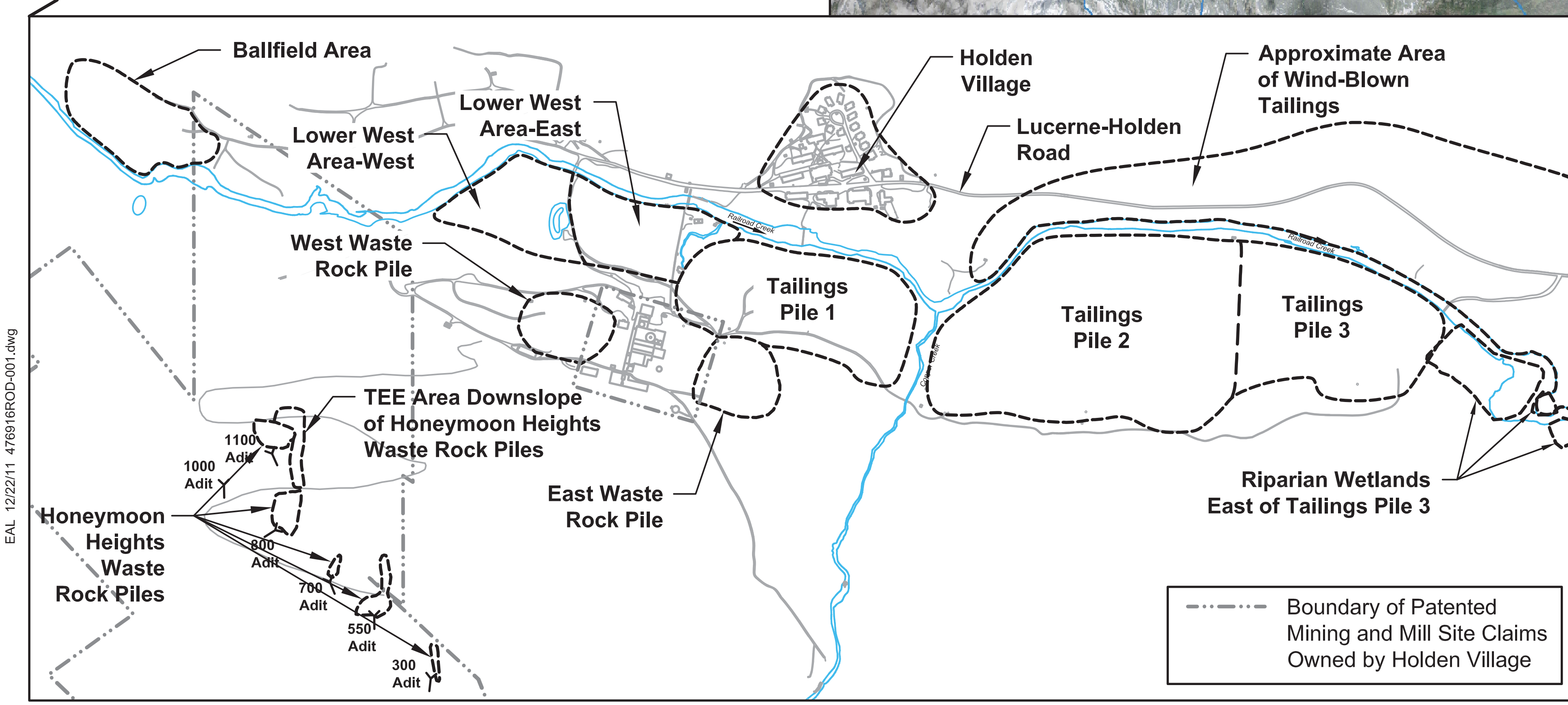
Figure 2

ROD

476916-AB.mxd EAL 12/21/11

Site Map



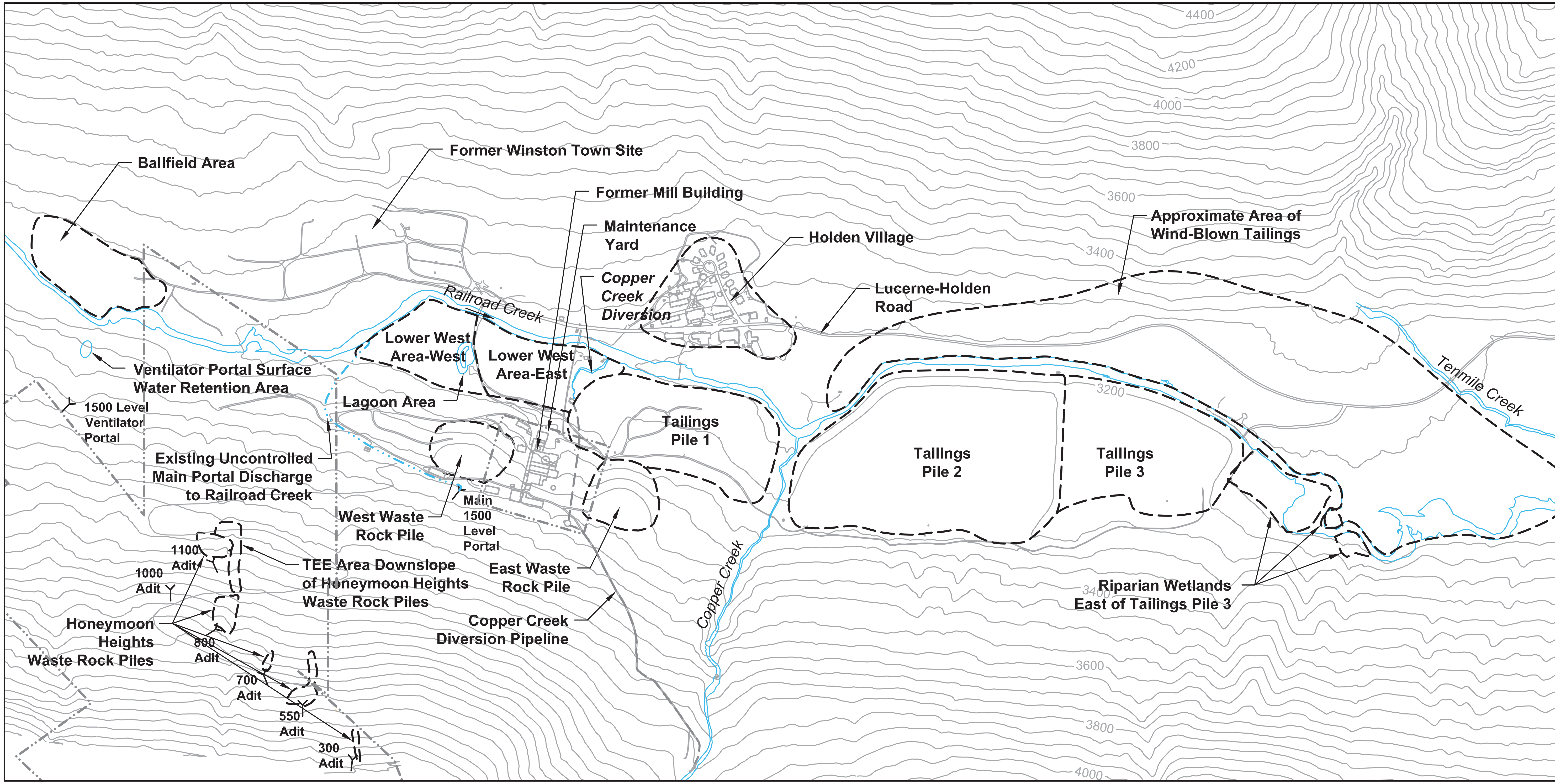


Holden Mine Features

0 900 1,800
Approximate Scale in Feet

HARTCROWSER
4769-16 12/11
Figure 3
ROD

Principal Site Features



EAL 12/22/11 476916ROD-002.dwg

Source: Base map from URS (2004). Various features from DRI, DFFS, Draft TEE Report, and airphoto interpretation by Forest Service.

Boundary of Patented Mining and Mill Site Claims Owned by Holden Village

Note: Contour interval is 50 feet.

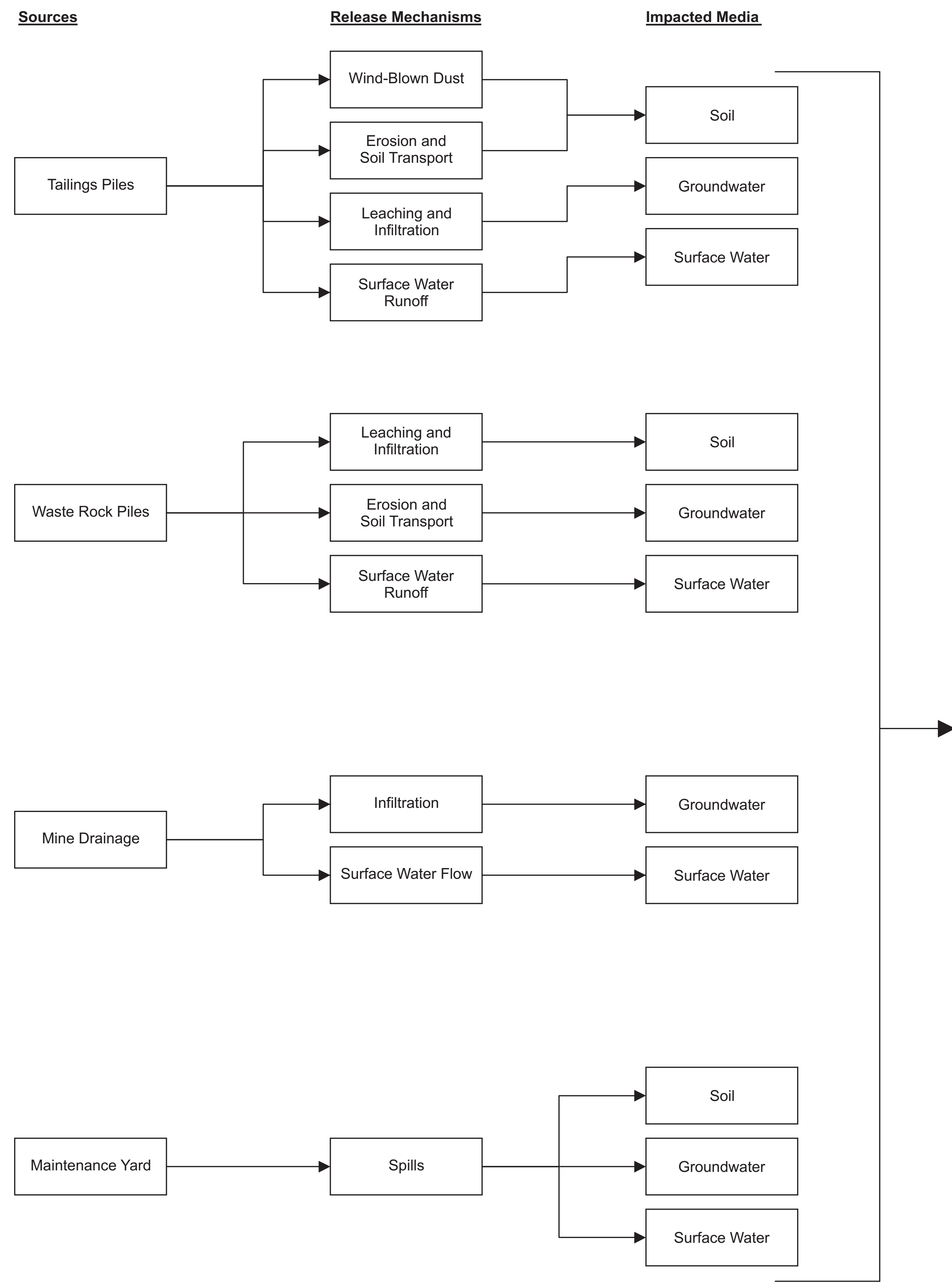
0 660 1320
Scale in Feet

N

HARTCROWSER

4769-16 *12/11*
Figure 4
ROD

Summary Conceptual Site Model



Impacted Media	Route	Resident	Visitor	Worker	Terrestrial Biota	Aquatic Biota
Soil	Inhalation	●	●	●	◐	
	Dermal Contact	◐	◐	◐	●	
	Ingestion	●	●	●	●	
Groundwater	Inhalation	◐	◐	◐		
	Dermal Contact	◐	◐	◐	◐	
	Ingestion	●	●	●		
Surface Water	Inhalation					
	Dermal Contact	●	●	●	◐	●
	Ingestion	●	●	●	●	●
Sediment	Inhalation					
	Dermal Contact	◐	◐	◐	◐	●
	Ingestion	●	●	●	◐	●
Biota*	Inhalation					
	Dermal Contact					
	Ingestion	●	●	●	●	●

Legend

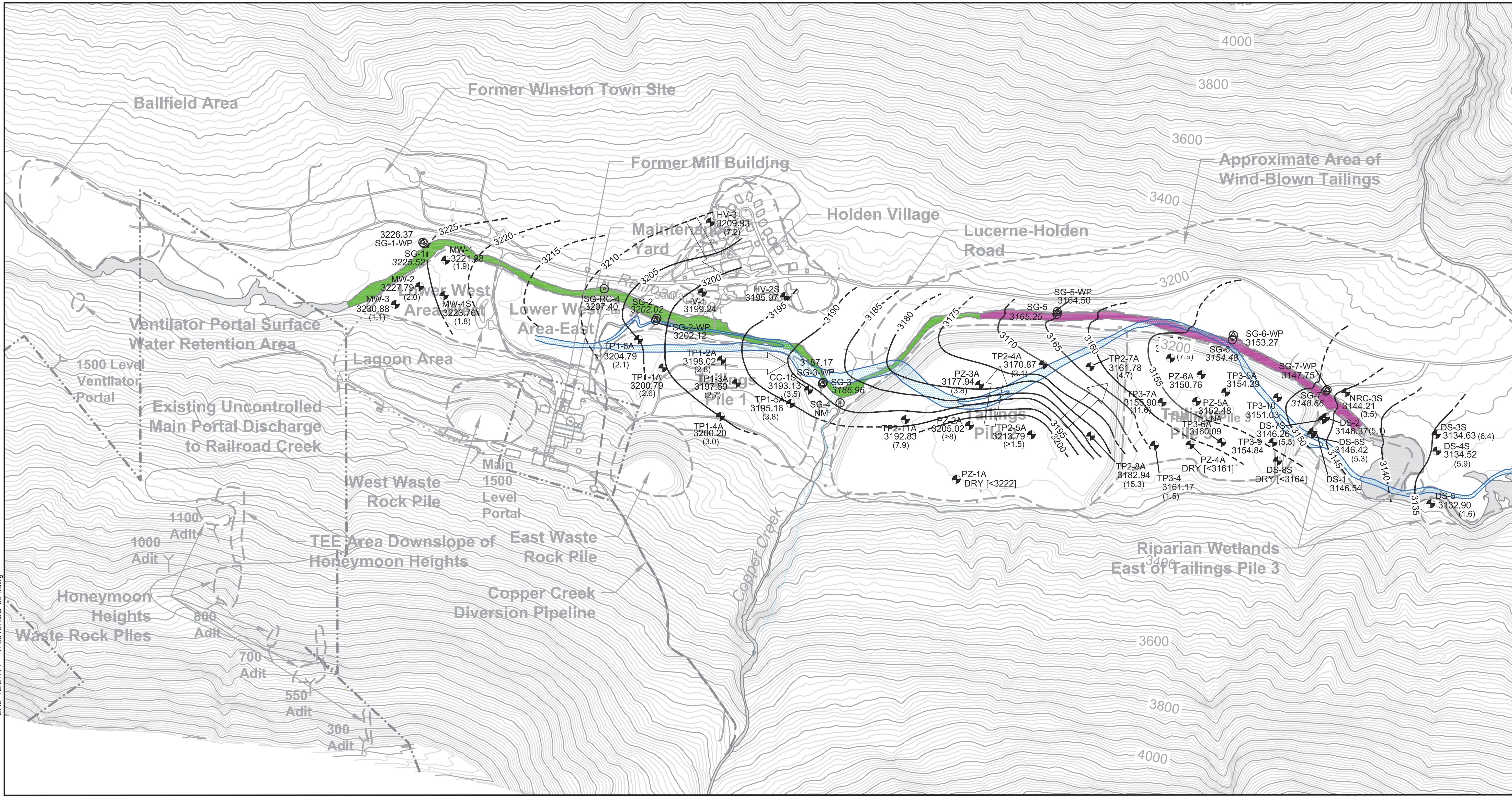
● Complete Pathway

◐ Insignificant Pathway

(No Symbol) Incomplete Pathway

*Biota (e.g., homegrown vegetables, insects, fish, plants) may be considered a secondary source that accumulate contaminants of concern from impacted soil, sediment, surface water, and groundwater and may be consumed by humans or ecological receptors. In addition to being a secondary source, terrestrial and aquatic biota are also receptors.

Groundwater Elevations and Generalized Flow Map - July 2008



Legend

- Monitoring Well
- Well Point
- 3190.9 Groundwater Elevation, feet above mean sea level
- Groundwater Contour, feet above mean sea level (Dashed Where Inferred)
- Staff Gage
- *3125.52* Surface Water Elevation, feet above mean sea level
- NM Not Measured
- Estimated Extent of Gaining Reach of Railroad Creek
- Estimated Extent of Losing Reach of Railroad Creek
- Creek Channels in 1937 Based on Howe Sound Map
- Groundwater Flow Direction

Note: Contour interval is 10 feet.

0 600 1200
Scale in Feet

N

HARTCROWSER

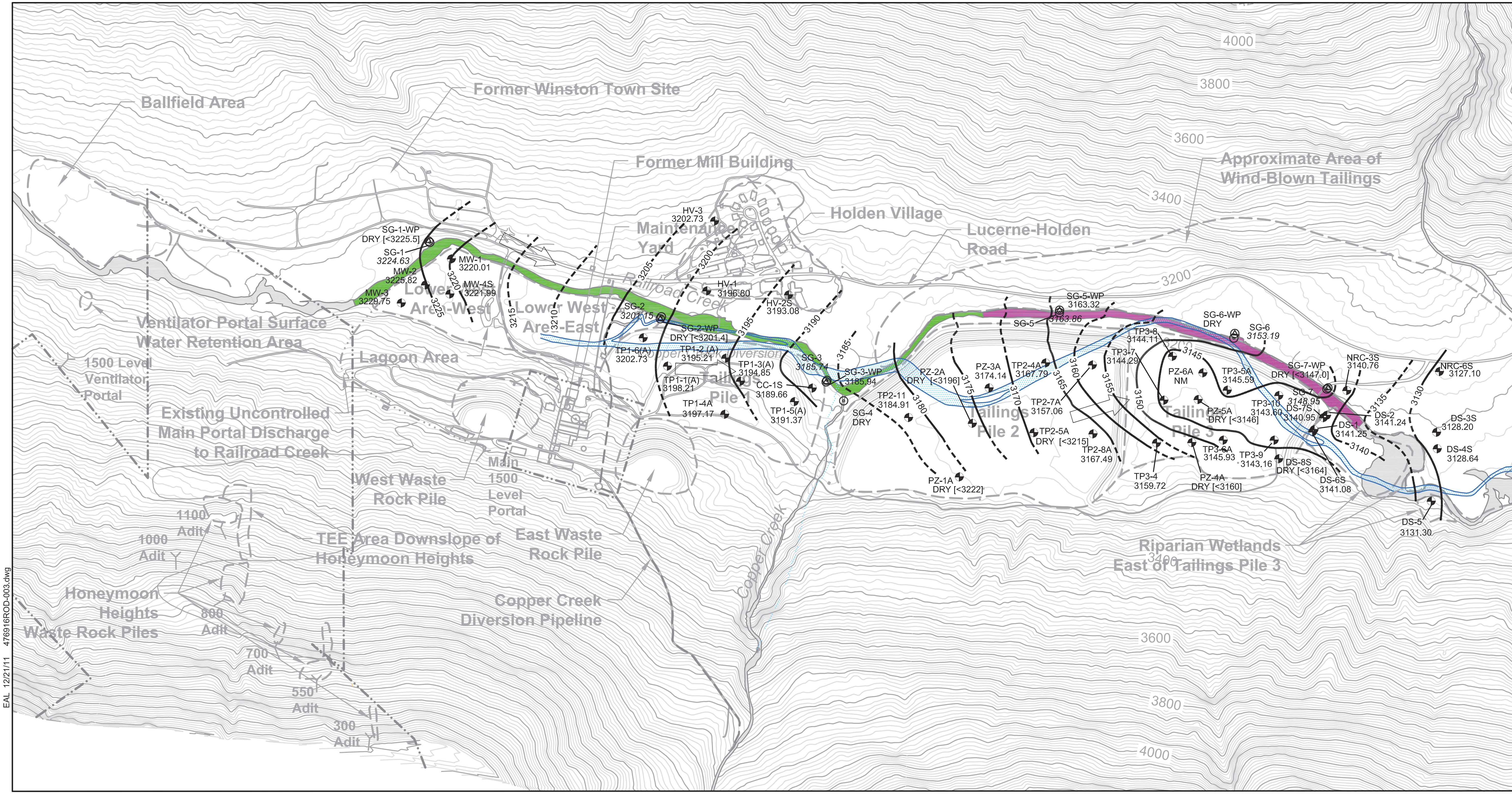
4769-16 **12/11**

Figure 6 **Sheet 1 of 2**

ROD

Source: Prepared from Figures E2-16 and D3-1, Draft Alternative 13M Evaluation Report, ERM and URS, 2009.

Groundwater Elevations and Generalized Flow Map - October 2008



Legend

- Monitoring Well
- Well Point
- 3190.9 Groundwater Elevation, feet above mean sea level
- Groundwater Contour, feet above mean sea level (Dashed Where Inferred)
- Staff Gage
- *3125.52* Surface Water Elevation, feet above mean sea level
- NM Not Measured
- Estimated Extent of Gaining Reach of Railroad Creek
- Estimated Extent of Losing Reach of Railroad Creek
- Creek Channels in 1937 Based on Howe Sound Map
- Groundwater Flow Direction

Note: Contour interval is 10 feet.

0 600 1200
Scale in Feet

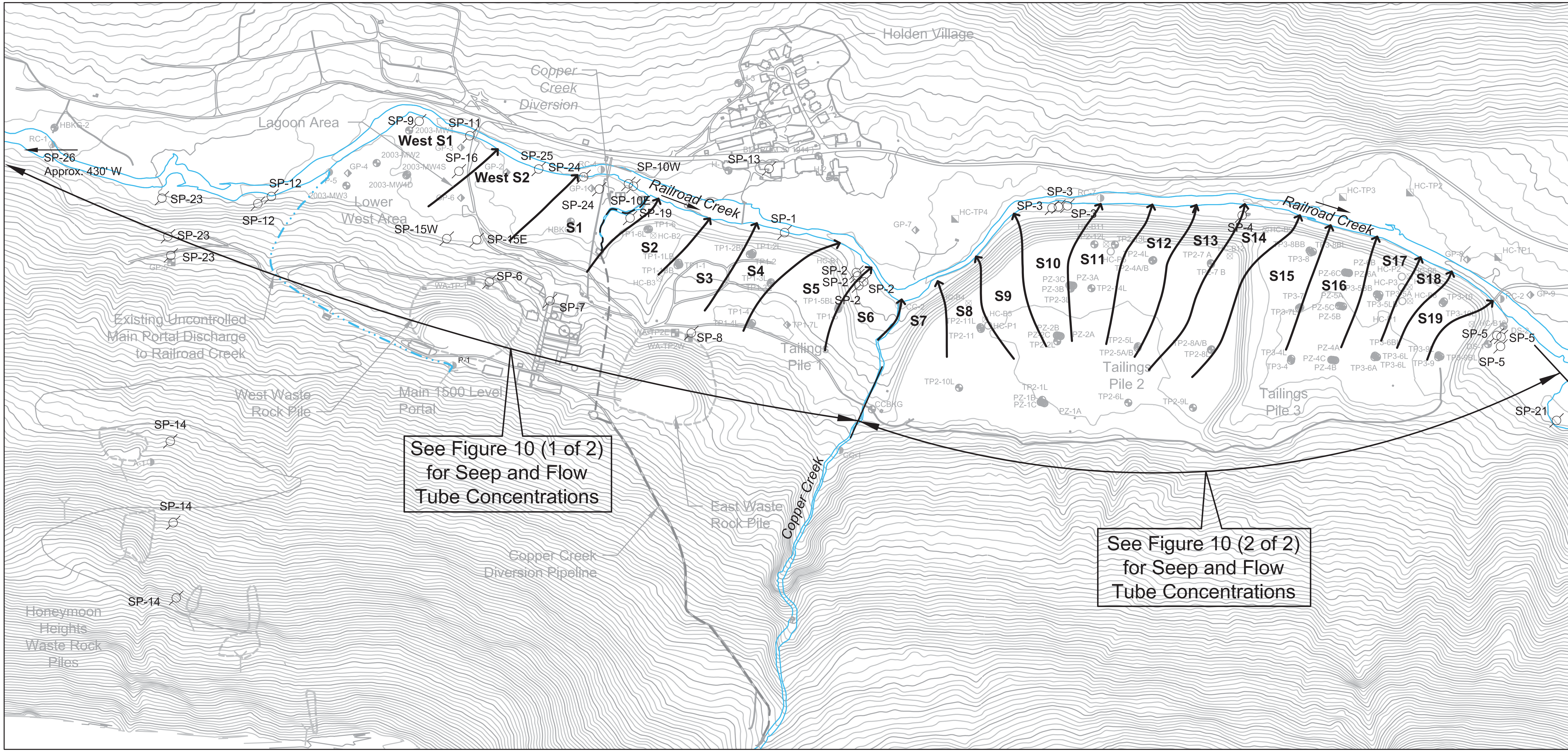
N

HARTCROWSER

4769-16 *12/11*
Figure 6 *Sheet 2 of 2*
ROD

Source: Prepared from Figures E2-16 and D3-1, Draft Alternative 13M Evaluation Report, ERM and URS, 2009.

Seeps and Flow Tubes That Discharge into Railroad Creek for Spring Conditions



EAL 12/21/11 476916ROD-007.dwg

Approximate Exploration Location

- Monitoring Well
- Boring
- Test Pit
- Percolation Test
- Surface Water Sample
- Waste Rock Pile

- Inferred Groundwater Flow Path
- **S4** Flow Tube Designation
- SP-25 Seep Location and Designation

Notes: Seep and flow tube locations and designations from URS, 2004a and Hart Crowser, 2005a.

Groundwater flow and concentrations vary seasonally due primarily to the effect of snowmelt and runoff. As used in the SFS and related documents, spring conditions refer to the period approximately 90 days from May through June when snowmelt causes relatively high groundwater levels. See text for additional discussions.

Contour interval is 10 feet.

N

0 500 1000

Scale in Feet

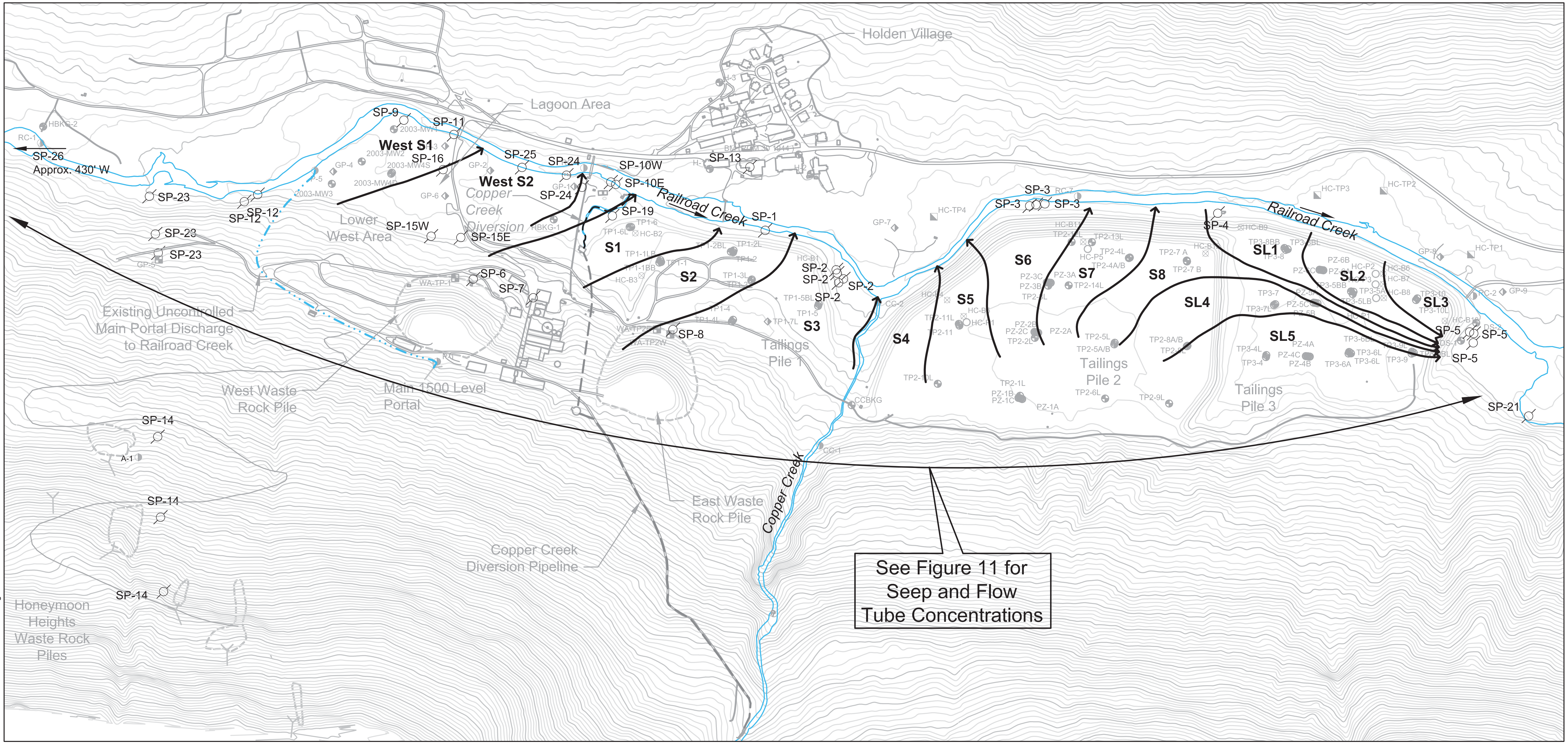
HARTCROWSER

4769-16 ***12/11***

Figure 7

ROD

Seeps and Flow Tubes That Discharge into Railroad Creek for Fall Conditions



Approximate Exploration Location

- Monitoring Well
- Boring
- Test Pit
- Percolation Test
- Surface Water Sample
- Waste Rock Pile

Inferred Groundwater Flow Path

S4 Flow Tube Designation

SP-25 Seep Location and Designation

Notes: Seep and flow tube locations and designations from URS, 2004a and Hart Crowser, 2005a.

Groundwater flow and concentration vary seasonlly due primarily to the effect of snowmelt and runoff. As used in the SFS and rlated documents, fall flow conditions are assumed to be representative of all low flow seasons (i.e., August through April). See text for additional discussion.

Contour interval is 10 feet.

N

0 500 1000

Scale in Feet

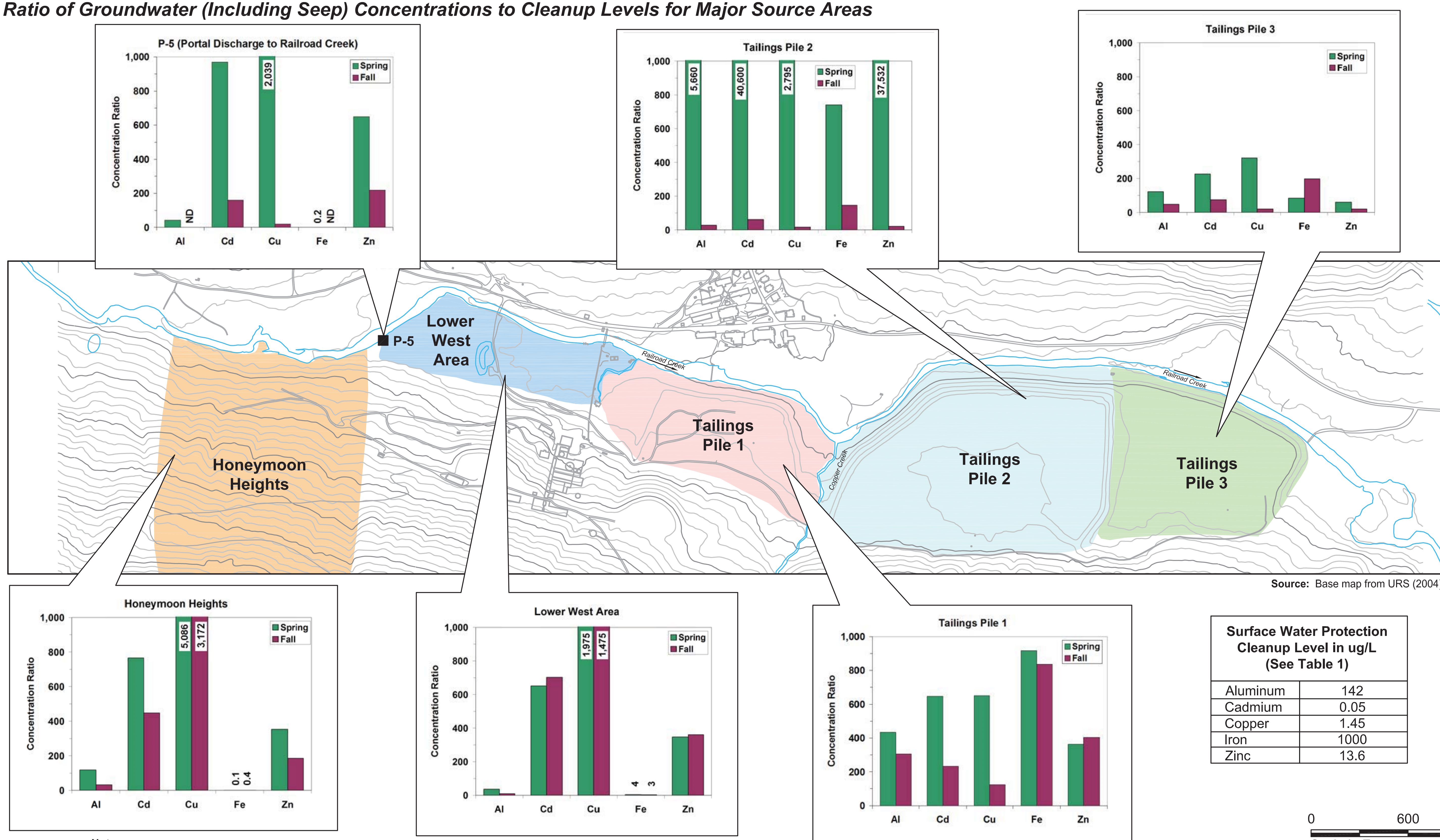
HARTCROWSER

4769-16 *12/11*

Figure 8

ROD

Ratio of Groundwater (Including Seep) Concentrations to Cleanup Levels for Major Source Areas



Source: Base map from URS (2004).

Surface Water Protection Cleanup Level in ug/L (See Table 1)	
Aluminum	142
Cadmium	0.05
Copper	1.45
Iron	1000
Zinc	13.6

Notes:
1. Plots show the ratio of the constituent concentrations (shown in Table 4) to the cleanup levels (shown in Table 11). Concentration Ratio = Constituent Concentration/Cleanup Level.
2. Additional details on the determination of constituent concentrations are noted on Table 7 in the ASFS, 2010.
3. Additional details on cleanup levels are provided in the text and noted on Table 1 in the ASFS, 2010.
4. Vertical scales of plots vary. The numerical values of any ratios that exceed the vertical scale of the plot are noted.
5. "ND" indicates all sample results were non-detect.
6. Al = Aluminum, Cd = Cadmium, Cu = Copper, Fe = Iron, and Zn = Zinc.
7. Lead data is not shown because available data may not be representative due to inconsistent analyses for lead concentrations.
8. Contour interval is 20 feet.
9. Cleanup level based on protection of surface water for groundwater discharging to surface water.

EAL 12/21/11 476916ROD-005.dwg

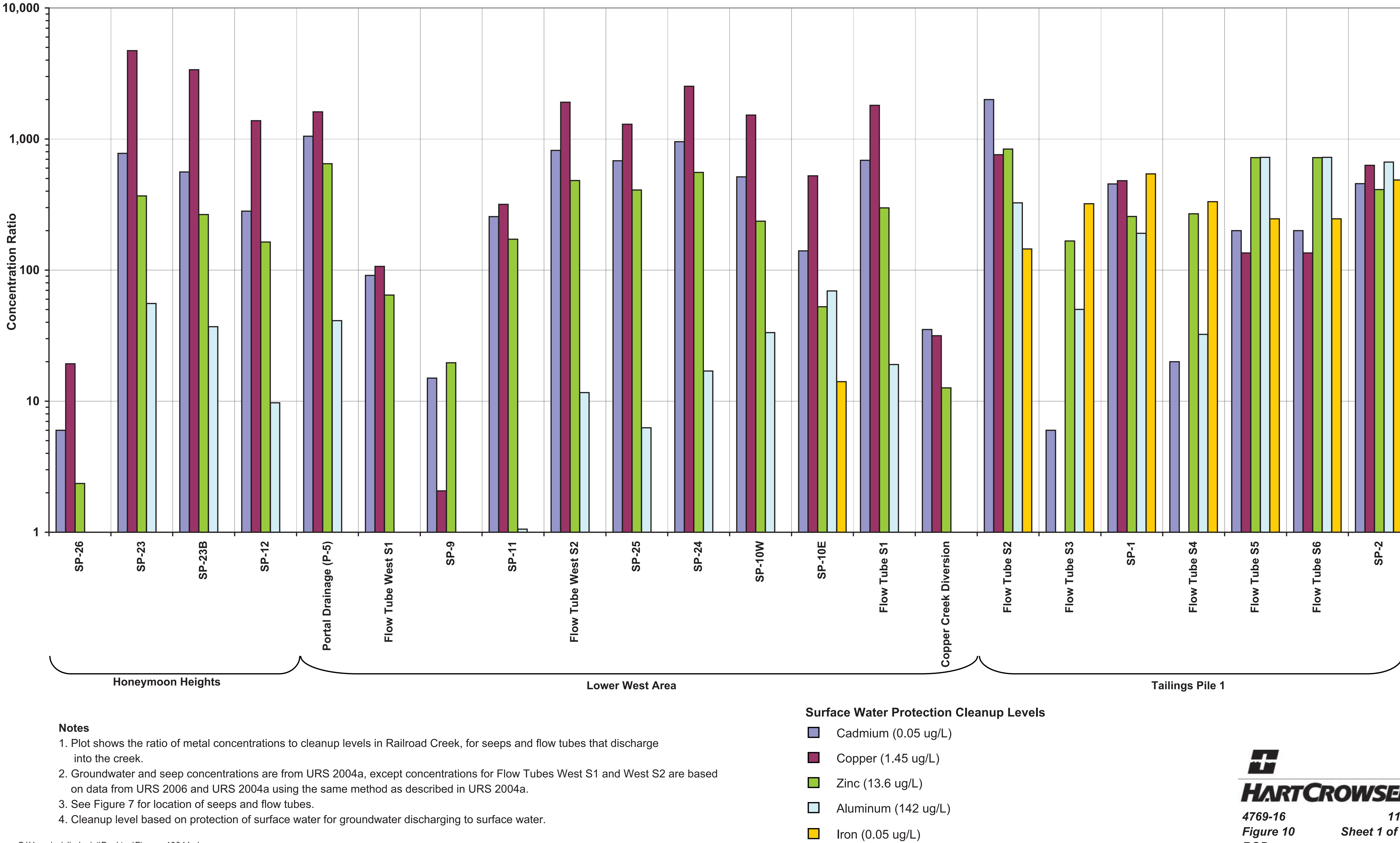
HARTCROWSER

4769-16 12/11

Figure 9

ROD

Ratio of Groundwater (Including Seep) Concentrations to Cleanup Levels for Spring Conditions
Sources Discharging into Railroad Creek from West to East



Notes

1. Plot shows the ratio of metal concentrations to cleanup levels in Railroad Creek, for seeps and flow tubes that discharge into the creek.
2. Groundwater and seep concentrations are from URS 2004a, except concentrations for Flow Tubes West S1 and West S2 are based on data from URS 2006 and URS 2004a using the same method as described in URS 2004a.
3. See Figure 7 for location of seeps and flow tubes.
4. Cleanup level based on protection of surface water for groundwater discharging to surface water.

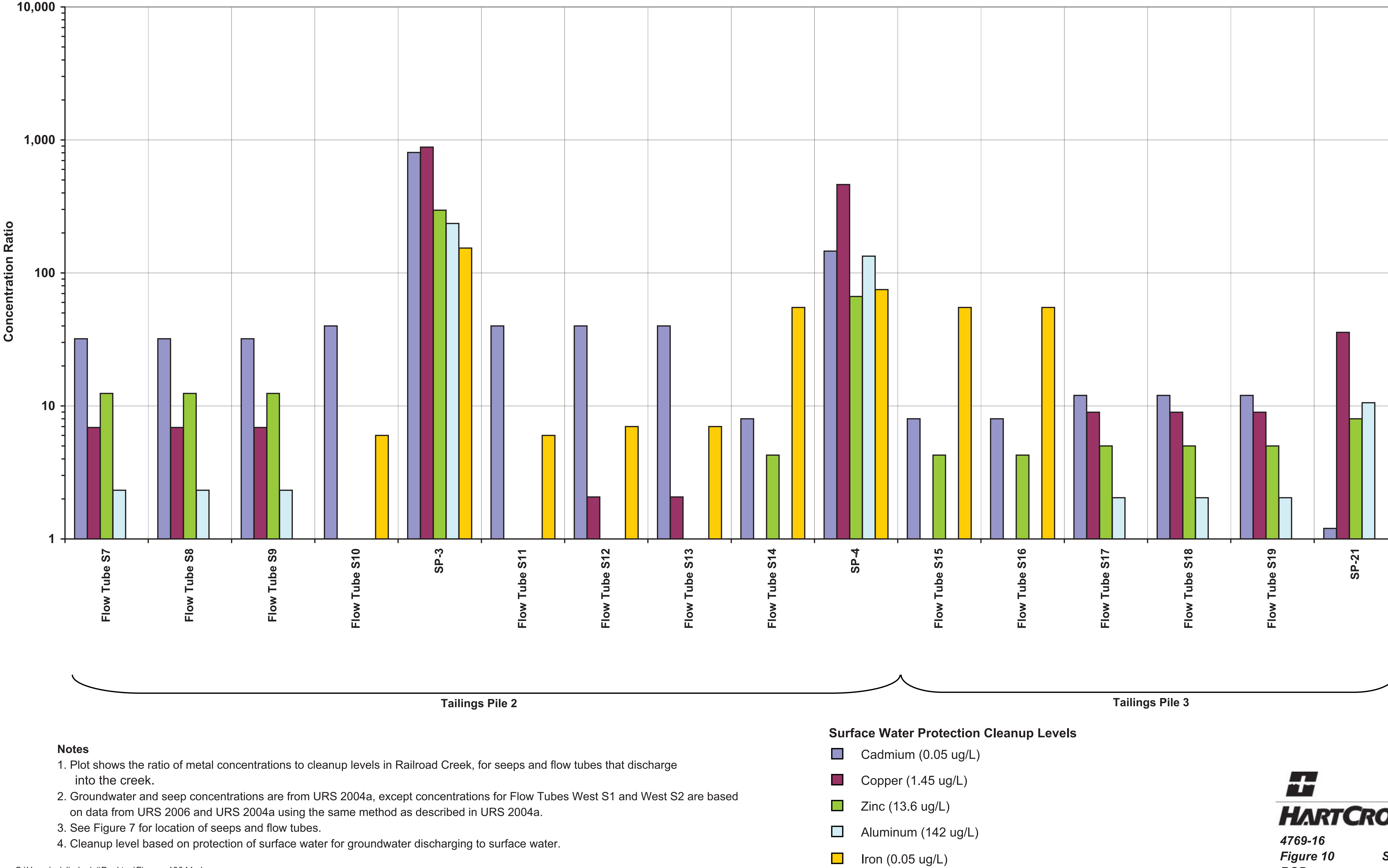
C:\Users\ericlindquist\Desktop\Figures 10&11.xls

HARTCROWSER

4769-16 11/11
Figure 10 Sheet 1 of 2
ROD

Ratio of Groundwater (Including Seep) Concentrations to Cleanup Levels for Spring Conditions

Sources Discharging into Railroad Creek from West to East



Notes

1. Plot shows the ratio of metal concentrations to cleanup levels in Railroad Creek, for seeps and flow tubes that discharge into the creek.
2. Groundwater and seep concentrations are from URS 2004a, except concentrations for Flow Tubes West S1 and West S2 are based on data from URS 2006 and URS 2004a using the same method as described in URS 2004a.
3. See Figure 7 for location of seeps and flow tubes.
4. Cleanup level based on protection of surface water for groundwater discharging to surface water.

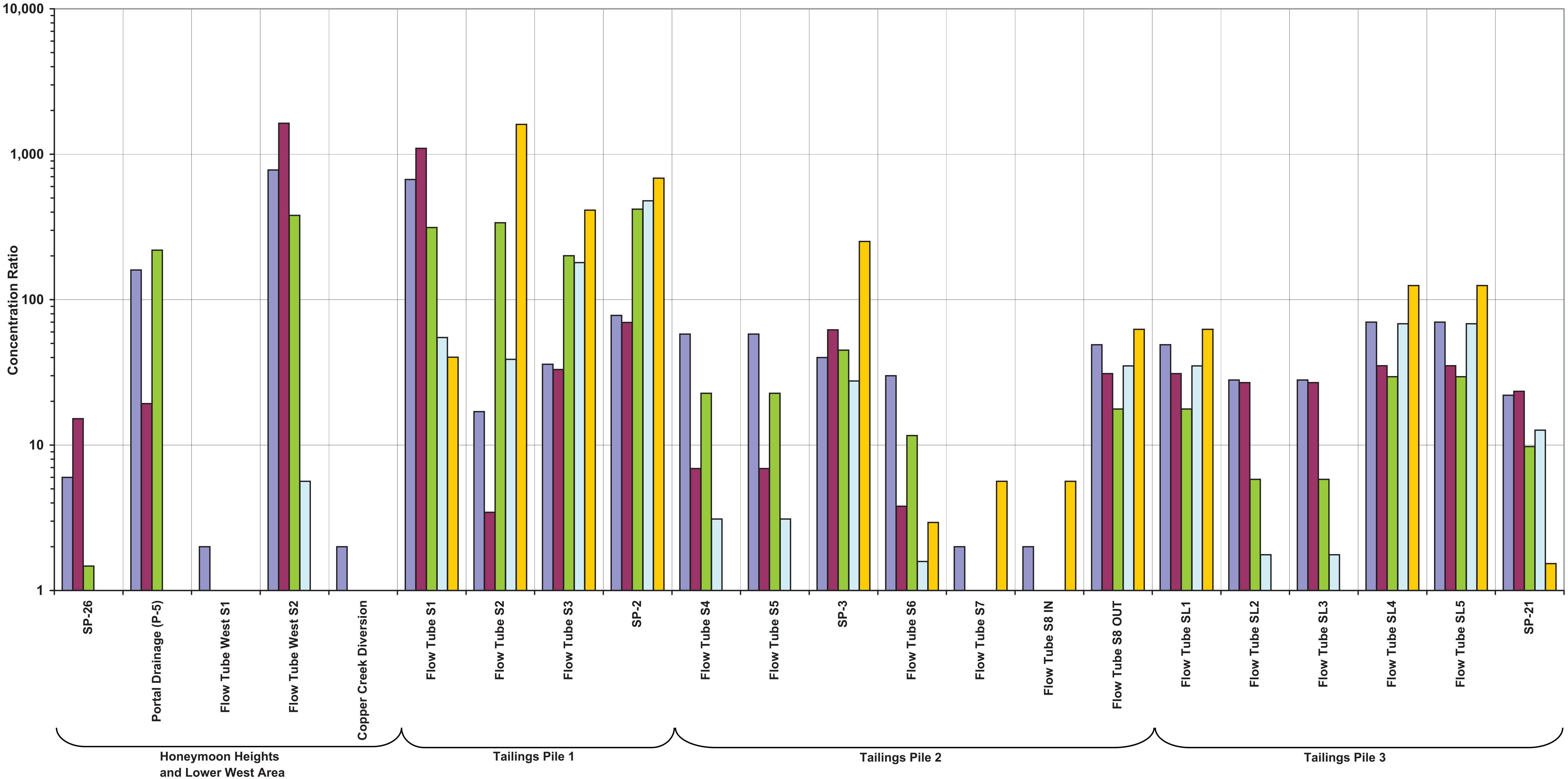
C:\Users\ericlindquist\Desktop\Figures 10&11.xls

HARTCROWSER

4769-16 *11/11*
Figure 10 *Sheet 2 of 2*
ROD

Ratio of Groundwater (Including Seep) Concentrations to Cleanup Levels for Fall Conditions

Sources Discharging into Railroad Creek from West to East



Surface Water Protection Cleanup Levels

- Cadmium (0.05 ug/L)
- Copper (1.45 ug/L)
- Zinc (13.6 ug/L)
- Aluminum (142 ug/L)
- Iron (0.05 ug/L)

Notes

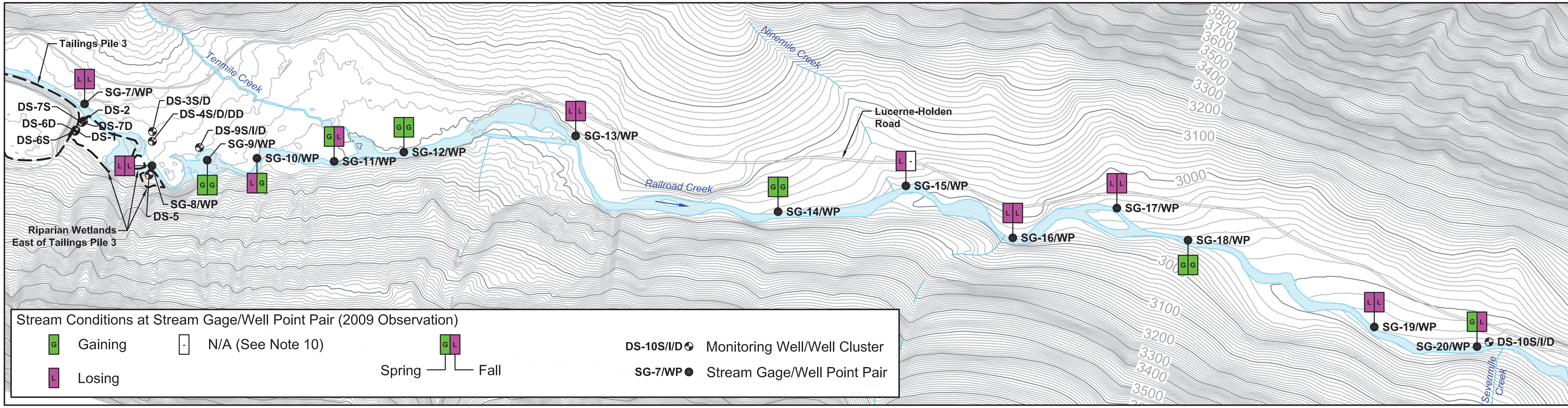
1. Plot shows the ratio of metal concentrations to cleanup levels in Railroad Creek, for seeps and flow tubes that discharge into the creek.
2. Groundwater and seep concentrations are from URS 2004a, except concentrations for Flow Tubes West S1 and West S2 are based on data from URS 2006 and URS 2004a using the same method as described in URS 2004a.
3. See Figure 8 for location of seeps and flow tubes.
4. Fall concentrations are assumed to be representative of all low flow seasons (i.e., summer, fall, and winter). See text for explanation.
5. Cleanup level based on protection of surface water for groundwater discharging to surface water.

C:\Users\ericlindquist\Desktop\Figures 10&11.xls - Fall - Figure 11

HARTCROWSER

4769-16 *11/11*
Figure 11
ROD

Groundwater Concentrations and Railroad Creek Stream Conditions East of Tailings Pile 3



EAL 12/21/11 476916ROD-015.dwg

Source: Base map from URS (2009).

Season	Constituent (ug/L)	DS-1	DS-2	DS-3S	DS-3D	DS-4S	DS-4D	DS-4DD	DS-5	DS-6S	DS-6D	DS-7S	DS-7D	DS-9S	DS-9I	DS-9D	DS-10S	DS-10I	DS-10D	SG-9-WP	SG-10-WP	SG-11-WP	SG-12-WP	SG-13-WP	SG-18-WP	SG-20-WP
Spring 2009	Aluminum	50 U	10,900	50 U	50 U	50 U	50 U	--	50 U	50 U	50 U	1,940	50 U	50 U	9,730	50 U	50 U	50 U	50 U	--	--	--	--	--	--	--
	Cadmium	0.3	1.7	0.2 U	0.2	0.2 U	0.2 U	--	0.2 U	0.3	0.4	1.2	0.2 U	0.2 U	3	0.2 U	0.2 U	0.2 U	0.2 U	--	--	--	--	--	--	--
	Copper	3.2	42.2	0.5	0.5 U	0.5 U	0.5U	--	0.5 U	0.3	0.5 U	19.7	0.5 U	0.5 U	16.5	0.5 U	0.5 U	0.5 U	0.5 U	--	--	--	--	--	--	--
	Iron	50 U	100	50 U	50 U	50 U	50 U	--	50 U	50 U	50 U	50 U	50 U	50 U	10,800	50 U	50 U	50 U	50 U	--	--	--	--	--	--	--
	Zinc	36	168	12	15	11	13	--	4 U	4 U	4 U	125	4 U	4 U	440	13	4 U	4 U	4 U	--	--	--	--	--	--	--
Fall 2009	Aluminum	50 U	33,700	50 U	50 U	50 U	70	50 U	50 U	410	50 U	630	50 U	50 U	4,860	50 U	50 U	50 U	50 U	50 U	1,500	60	50 U	200	50	50 U
	Cadmium	0.3	2.5	0.2	0.2	0.2 U	0.2 U	0.2 U	0.2 U	1.9	0.4	0.2 U	0.2 U	0.2 U	1.4	0.2 U	0.2 U	0.2 U	0.2 U	2.03	4.45	1.64	4.8	3.1	0.87	0.26
	Copper	3	104	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	13.4	0.5 U	0.5 U	0.5 U	0.5 U	9.5	0.5 U	0.5 U	0.5 U	0.5 U	2.3	10.2	0.7	2.7	3	0.9	0.5
	Iron	50 U	117,000	50 U	50 U	50 U	50 U	50	50 U	22,400	50 U	356,000	50 U	50 U	240	50 U	50 U	50 U	50 U	50 U	50 U	20,100	4,460	160	330	90
	Zinc	40	258	17	15	24	17	39	9	46	4 U	53	4 U	12	180	4 U	12	4 U	4 U	22.5	138	6.5	5	6	3	2
Spring 2010	Aluminum	50 U	11,900	50 U	50 U	50 U	140	50 U	50 U	50 U	50 U	2,260	50 U	50 U	8,630	100	50 U	50 U	50 U	50 U	1,280	90	50 U	50 U	50 U	50 U
	Cadmium	0.3	1.6	0.2 U	0.2 U	0.2 U	0.3	0.2 U	0.2 U	0.4	0.5	1.4	0.2 U	0.2 U	2.2	0.2 U	0.2 U	0.2 U	0.2 U	0.4	1.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
	Copper	3.6	53.2	0.5 U	1.3	0.5 U	0.6	0.5 U	0.5 U	0.6	0.6	21.5	0.5 U	0.5 U	13	0.5 U	0.5 U	0.5 U	0.5 U	3.2	7.4	0.5 U	0.5 U	0.5 U	0.9	0.8
	Iron	50 U	900	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	90	50 U	50 U	4,610	50 U	50 U	50 U	50 U	50 U	50 U	11,900	6,750	50 U	50 U	60
	Zinc	43	155	17	16	17	24	4 U	4 U	4 U	4	136	4 U	18	252	4 U	4 U	4 U	15	34	111	25	4 U	4 U	4 U	4 U
Fall 2010	Aluminum	32 T	39,800	16 T	30 T	14.8 U	120	750	42 T	720	18 T	700 D	100	14.8 U	3,010	17 T	29 T	14.8 U	43 T	50 U	840	120	16 T	14.8 U	27 T	44 T
	Cadmium	0.4	2.8	0.2	0.23	0.2	0.2	0.16 T	0.06 T	1.4	0.3	0.11 T	0.1 T	0.18 T	1	0.06 T	0.03 T	0.022 U	0.03 T	0.2 D	1.2	0.06 T	0.11 T	0.15	0.2	0.1 T
	Copper	3.2	117	0.28 T	0.2	0.39 T	0.5	2.4	0.33 T	23.7	0.38 T	0.6	0.6	0.32 T	6.4	0.26 T	0.6	0.232 U	0.232 U	2.4 D	18.3	1.0 B	2.9	5	2.1	1.2 B
	Iron	7.9 T	114,000	7.2 U	7.2 U	26 T	15 T	590	17 T	39,100	12 T	505,000 D	90	7.2 U	40 T	24 T	21 T	8.0 T	15 T	15 TB	14 TB	13,000	3,470	44 TB	41 TB	130
	Zinc	42	330 D	18	14.9	28	19	27	7	46	1.9 T	46	5	16	130	7	0.81 U	2.3 T	1.1 T	25 D	118	8	12	3.4	5	3.0 T

Notes:

1. Stream conditions determined from paired well points and stream gages measured in June 2009 (spring) and October 2009 (fall), (as reported by URS in the draft Hydrogeological Technical Memorandum Addendum, dated February 24, 2010), May 2010 (spring) (as reported by URS in the Spring 2010 Data Compilation Report, dated November 2010), and November 2010 (fall) (as reported by MWH in the Draft Baseline Monitoring Report for Fall 2010, dated February 2011).
2. S/I/D indicate monitoring well clusters screened at shallow, intermediate, and deep relative depths, respectively.
3. -- Data not available.
4. U - Constituent not detected; reporting limit shown.
5. T - Analyte was positively identified between the reporting limit and detection limit; concentration is estimated.
6. B - Analyte detected in an associated blank.
7. D - Sample dilution required for analysis; reported values reflect the dilution.
8. Shaded cells indicate detected concentration exceeds cleanup level.
9. No groundwater concentration data available for SG-7-WP, SG-8-WP, SG-14-WP through SG-17-WP, and SG-19-WP.
10. N/A - Stream gaining/losing condition could not be determined because water elevations below field instrument measurement elevations.
11. Lead data is not shown because available data may not be representative due to inconsistent analyses for lead concentrations.
12. Cleanup level based on protection of surface water for groundwater discharging to surface water.

Surface Water Protection Cleanup Level in ug/L (See Table 1)	
Aluminum	142
Cadmium	0.05
Copper	1.45
Iron	1000
Zinc	13.6

0 1000 2000
Scale in Feet

N

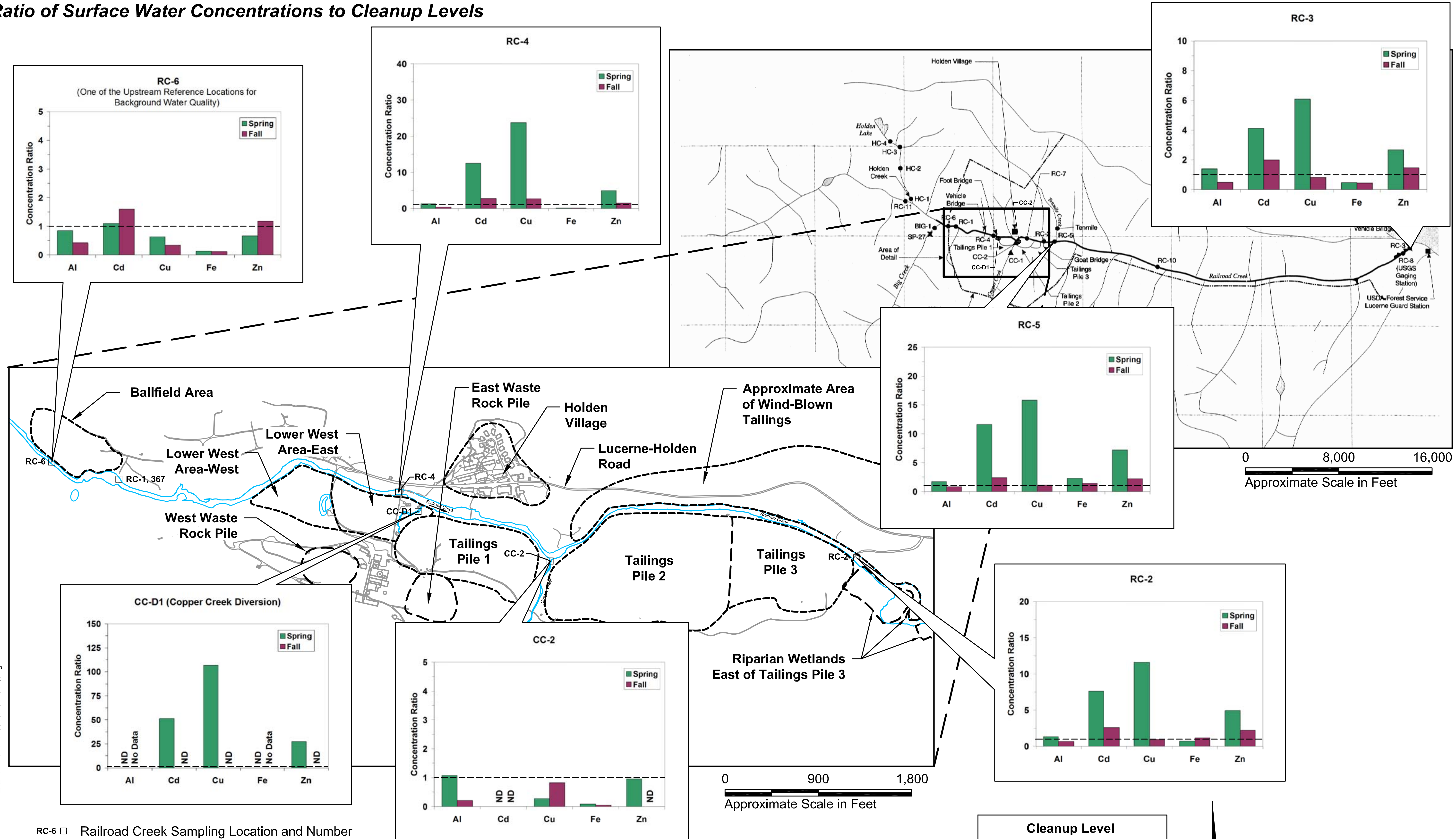
HARTCROWSER

4769-16 12/11

Figure 12

ROD

Ratio of Surface Water Concentrations to Cleanup Levels



RC-6 □ Railroad Creek Sampling Location and Number

Notes:

1. Plots show the ratio of the constituent concentrations shown in Table 9 to the cleanup levels shown in Table 1 in the ASFS, 2010. Concentration Ratio = Constituent Concentration/Cleanup Level.
2. Additional details on the determination of constituent concentrations are noted on Table 5 in the ASFS, 2010.
3. Additional details on cleanup levels are provided in the text and noted on Table 1 in the ASFS, 2010.
4. Vertical axis scales of plots vary. Horizontal dashed line identifies a concentration ratio of one in all plots.
5. "ND" indicates all samples were non-detect. "No Data" indicates samples were not analyzed for constituent.
6. Plots reflect constituent concentrations in grab samples taken from surface water under fully or partially mixed conditions and do not represent conditions at MTCA-defined conditional point(s) of compliance.
7. Al = Aluminum, Cd = Cadmium, Cu = Copper, Fe = Iron, and Zn = Zinc.
8. Lead data is not shown because available data may not be representative due to inconsistent analyses for lead concentrations.

Cleanup Level in ug/L (See Table 1)	
Aluminum	142
Cadmium	0.05
Copper	1.45
Iron	1000
Zinc	13.6

N

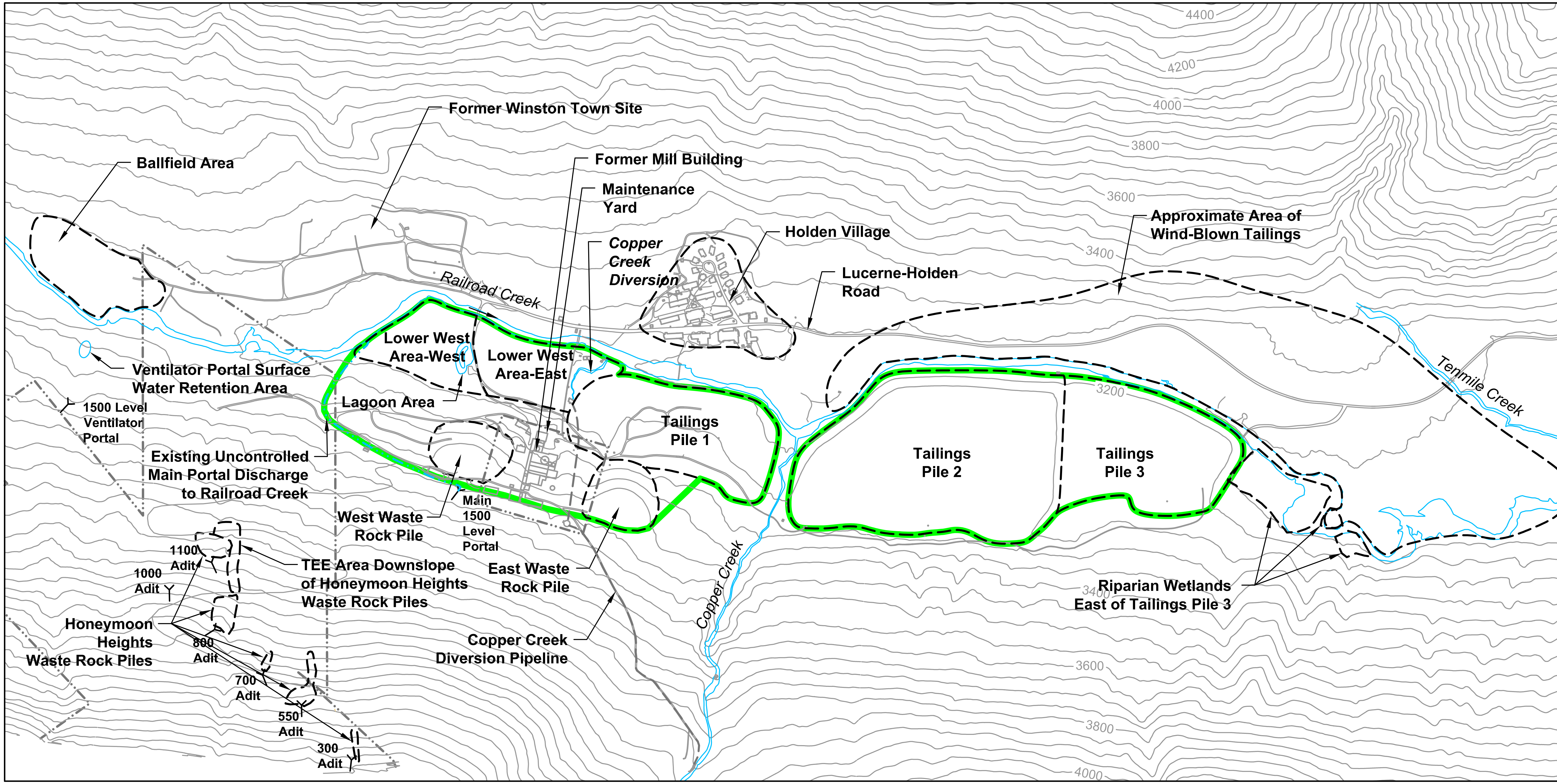
HARTCROWSER

4769-16 12/11

Figure 13

ROD

Waste Management Areas



Source: Base map from URS (2004). Various features from DRI, DFFS, and Draft TEE Report.

Boundary of Patented Mining and Mill Site Claims Owned by Holden Village

Approximate Limits of Waste Management Areas under Selected Remedy.

Note: Contour interval is 50 feet.

0 660 1320
Scale in Feet

N

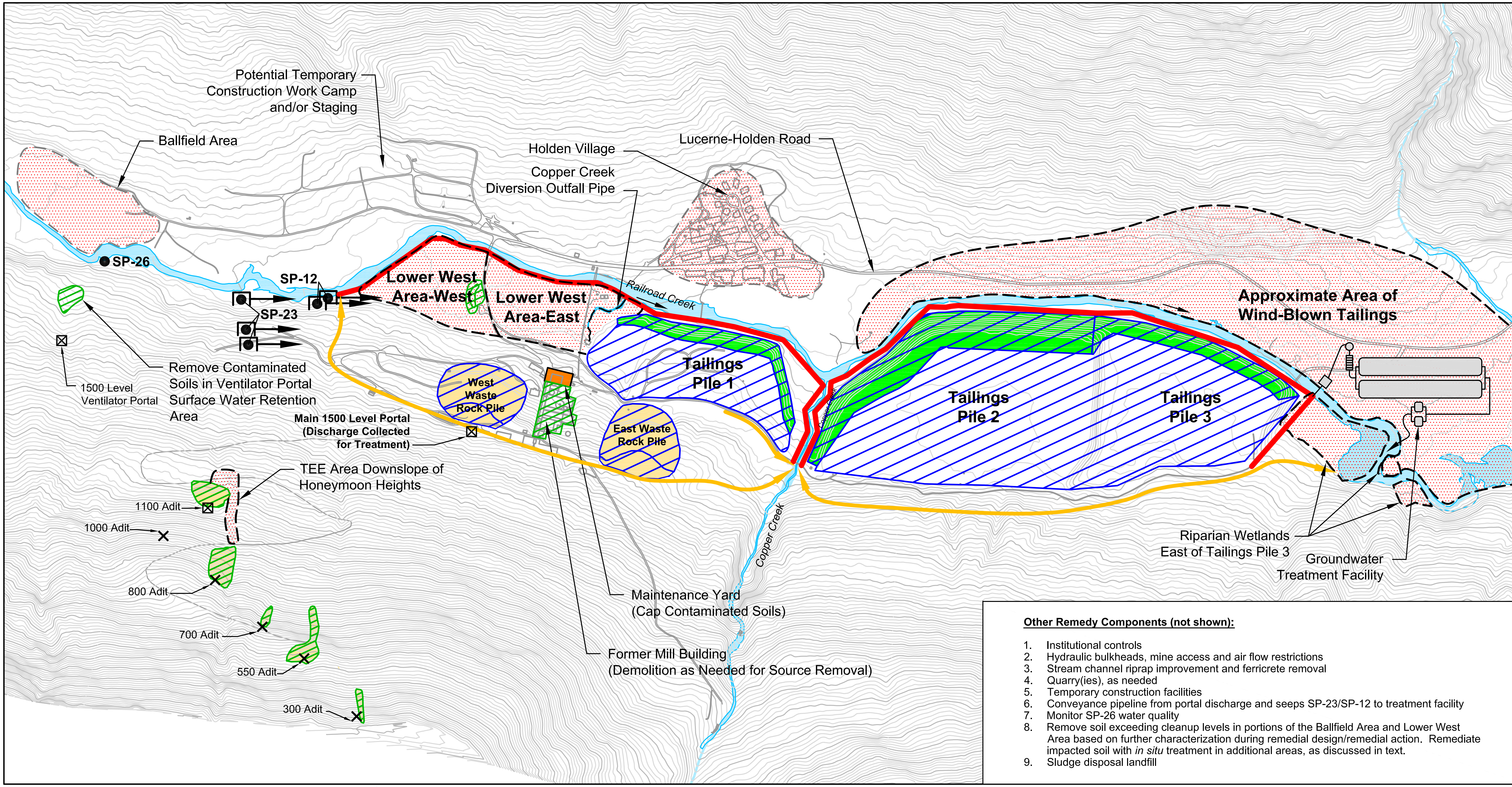
HARTCROWSER

4769-16 *12/11*

Figure 14

ROD

Principal Components of Alternative 11M



EAL 12/19/11 476916ROD-010.dwg

Source: Base map prepared from LiDAR topographic survey provided by URS 2004.

Notes:

1. Contour interval is 10 feet.
2. This figure shows conceptual layout and is not intended to depict engineering design.

Cap Contaminated Soil

Regrade Tailings and Waste Rock Piles, and Cap with 2 Feet of Soil and Geomembrane

Move Toe of Tailings Pile Slopes away from Creek as Part of Regrading

Remove Contaminated Soil or Waste Rock

Waste Rock Piles

Approximate Extent of *In Situ* Treatment Areas

SP-4 ● Seep Sampling Location and Number

Portal to be Closed with Hydrostatic Bulkhead

Portal to be Closed with Air Flow Restrictions

Groundwater Barrier Wall and Collection System

Upgradient Runoff Diversion Ditch

Discrete Seep Collection System

0 600 1200

Scale in Feet

N

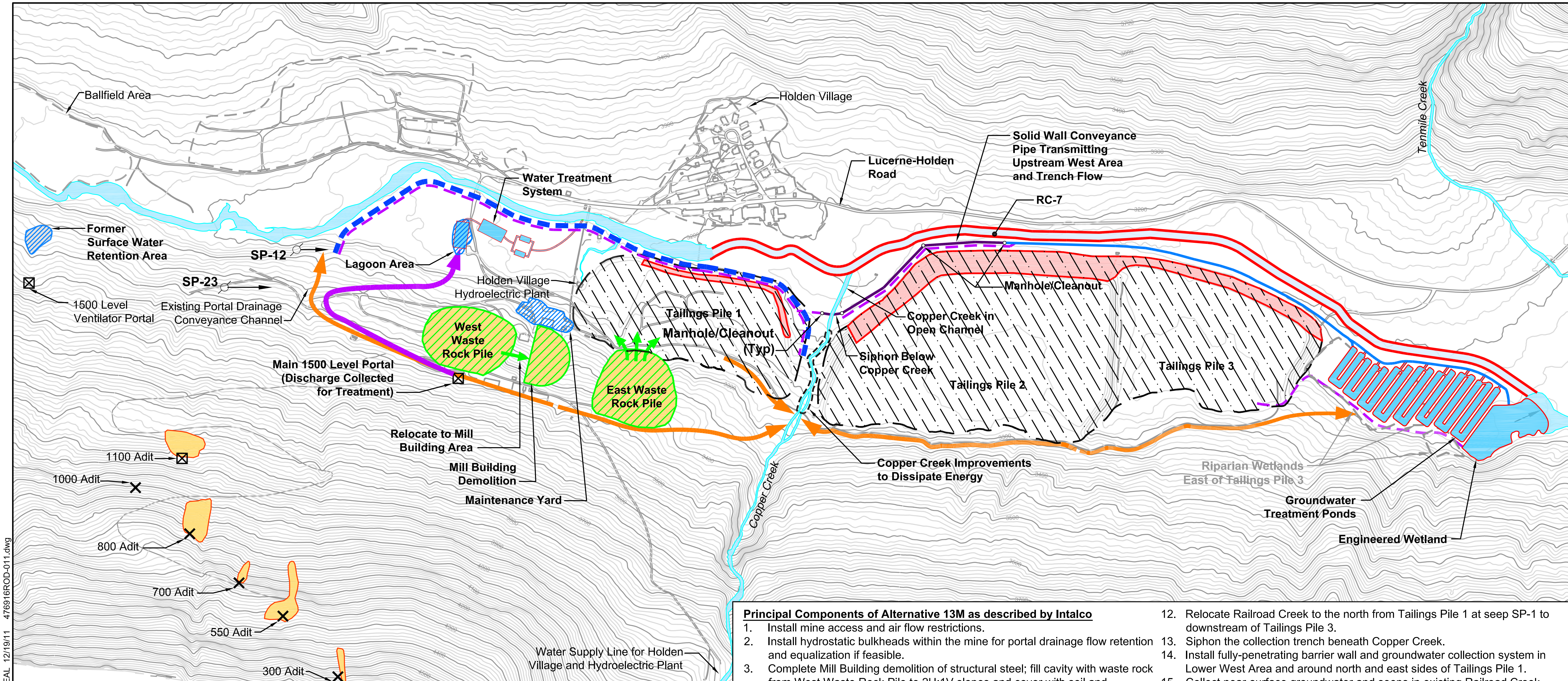
HARTCROWSER

4769-16 *12/11*

Figure 15

ROD

Principal Components of Alternative 13M



Principal Components of Alternative 13M as described by Intalco

1. Install mine access and air flow restrictions.
2. Install hydrostatic bulkheads within the mine for portal drainage flow retention and equalization if feasible.
3. Complete Mill Building demolition of structural steel; fill cavity with waste rock from West Waste Rock Pile to 2H:1V slopes and cover with soil and revegetate.
4. Remove contaminated materials in the Lagoon Area and former Surface Water Retention Area and pave Maintenance Yard.
5. Construct landfill on top of tailings piles for disposal of excavated impacted soils.
6. Bench and regrade Tailings Piles 1, 2, and 3 side slopes (2H:1V).
7. Cover top surfaces of tailings piles with gravel/soil/wood slash. Cover tailings pile side slopes with soil. Revegetate and install surface water drainage features.
8. Regrade East and West Waste Rock Pile side slopes (2H:1V), relocate waste rock removed during regrading to Mill Building area and tailings piles, cover remaining portions with soil and revegetate.
9. Stabilize Copper Creek channel and improve channel to dissipate energy.
10. Install water diversion swales upgradient of tailings and waste rock piles.
11. Provide discrete collection of portal drainage and seeps SP-23 and SP-12.
12. Relocate Railroad Creek to the north from Tailings Pile 1 at seep SP-1 to downstream of Tailings Pile 3.
13. Siphon the collection trench beneath Copper Creek.
14. Install fully-penetrating barrier wall and groundwater collection system in Lower West Area and around north and east sides of Tailings Pile 1.
15. Collect near-surface groundwater and seeps in existing Railroad Creek channel in unlined collection trench from Copper Creek downstream to approximately RC-7.
16. Construct two low-energy water treatment systems: one in the west area to treat collected portal drainage and seeps SP-23 and SP-12; one in the east area to treat remaining collected site water.
17. Construct landfill on top of tailings piles for disposal of sludge from water treatment system.

Legend

- Waste Rock Piles
- Regrade and Cover Waste Rock Piles with Soil
- Remove or Cover Contaminated Soil
- Regrade Tailings Pile Slopes
- Cover with Soil on Top Surface and on Slopes
- Waste Rock Pile Relocation
- Portal Drainage Conveyance Trench
- Upgradient Runoff Diversion Trench
- Fully-Penetrating Barrier Wall and Open Collection Trench
- Portal to be Closed with Hydrostatic Bulkhead
- Portal to be Closed with Air Flow Restrictions
- SP-23 Discrete Seep Collected for Treatment via Gravity Conveyance
- Existing Creeks
- Approximate Limits of Railroad Creek Realignment with Lining/Barrier System
- Unlined Collection or Conveyance Trench
- Lined Conveyance Channel or Treatment Trench with Drop Structures as needed
- Solid Wall Conveyance Pipe

N

Notes:

1. Railroad Creek stream banks are based on U.S. Forest Service data provided March 1998, which appears to be consistent with aerial photograph interpretation of stream flood banks.
2. Contour interval is 10 feet.
3. This figure shows conceptual layout and is not intended to depict engineering design.

0 600 1200
Scale in Feet

Source: ERM and URS (2009).

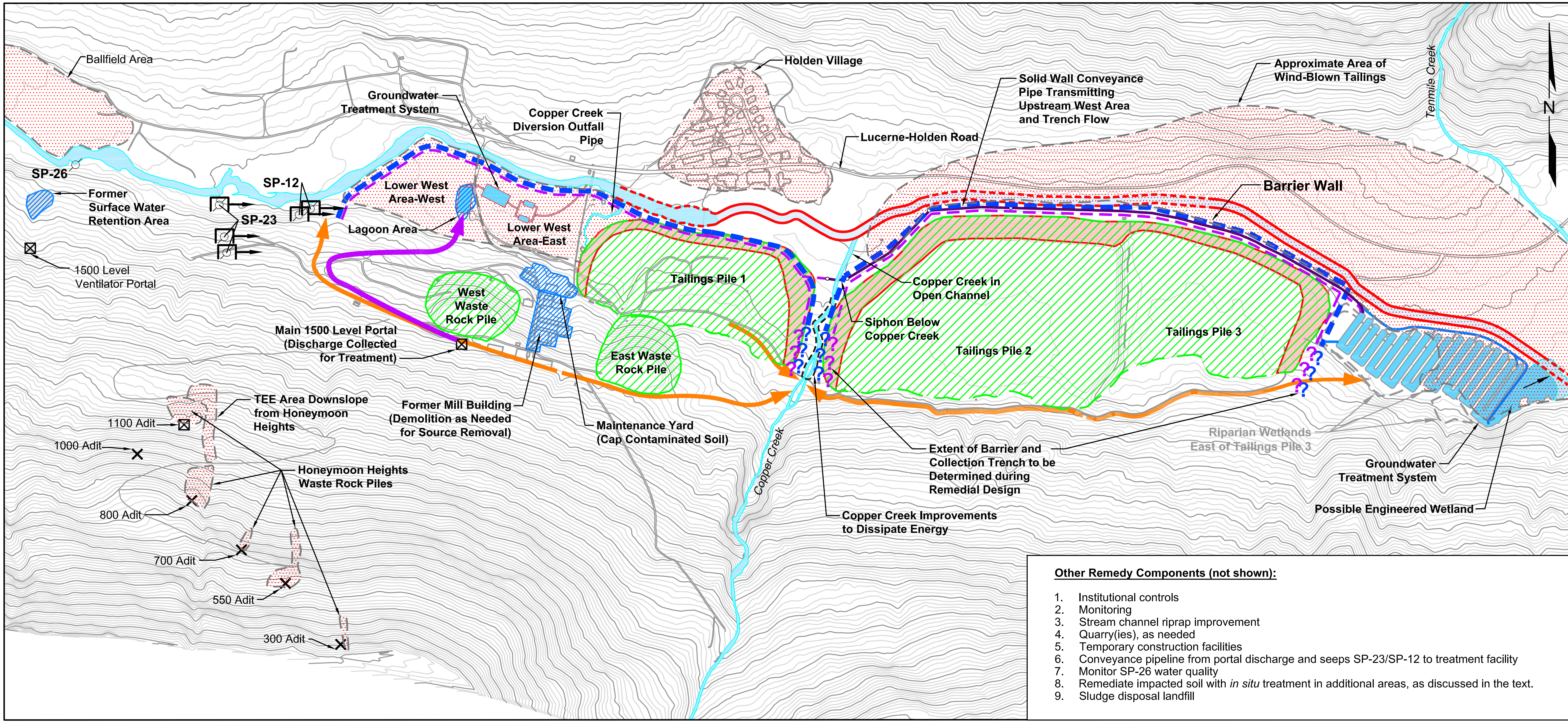
HARTCROWSER

4769-16 *12/11*

Figure 16

ROD

Principal Components of Alternative 14



Legend

- Regrade and Cap Tailings and Waste Rock Piles
- Remove or Cap Contaminated Soil
- Regrade Tailings Pile Slopes
- Approximate Extent of *In Situ* Treatment Areas
- Upgradient Runoff Diversion Trench
- Fully-Penetrating Barrier Wall and Open Collection Trench
- Portal Discharge Conveyance Trench
- Portal to be Closed with Hydrostatic Bulkhead
- Portal to be Closed with Air Flow Restrictions
- SP-23 Seep Collection for Treatment
- Existing Creeks
- Railroad Creek Realignment (Actual limits to be determined during remedial design)
- Unlined Collection or Conveyance Trench
- Lined Conveyance Channel or Treatment Trench with Drop Structures as needed
- Solid Wall Conveyance Pipe

Notes:
1. Contour interval is 10 feet.
2. This figure shows conceptual layout and is not intended to depict engineering design.

Source: Prepared from AutoCAD file "Alt 13M Contingent.dwg", created by URS, 06/24/09.

0 600 1200
Scale in Feet

EAL 12/19/11 476916ROD-012.dwg

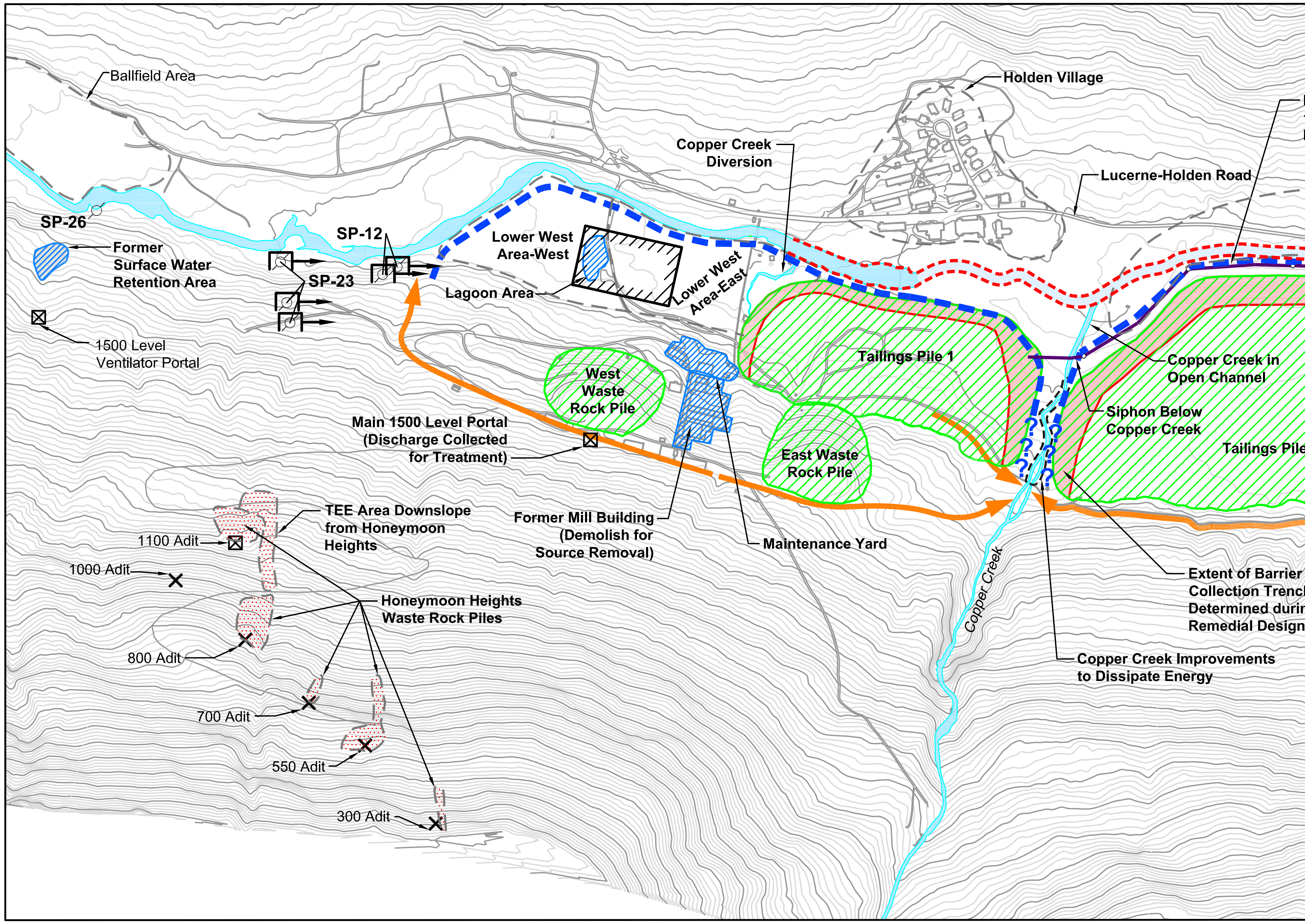
HARTCROWSER

4769-16 *12/11*

Figure 17

ROD

Principal Components of Selected Remedy



Other Remedy Components (not shown):

1. Institutional controls
2. Monitoring
3. Stream channel riprap improvement
4. Targeted source removal (e.g., in the Ballfield Area)
5. Temporary construction facilities (including quarries) as needed
6. Conveyance pipeline from portal discharge and seeps SP-23/SP-12 to treatment facility
7. Remove or cap impacted soil as discussed in text
8. Remediate impacted soil with *in situ* treatment in additional areas, as discussed in the text
9. Sludge disposal landfill

Legend

- Regrade and Cap Tailings and Waste Rock Piles
- Remove or Cap Contaminated Soils
- Regrade Tailings Pile Slopes
- Approximate Extent of *In Situ* Treatment Areas
- Upgradient Runoff Diversion Trench
- Fully-Penetrating Barrier Wall and Groundwater Collection Trench
- Portal to be Closed with Hydrostatic Bulkhead
- Portal to be Closed with Air Flow Restrictions
- SP-23 Seep Collection for Treatment
- Existing Creeks
- Railroad Creek Realignment (Actual limits to be determined during remedial design)
- Phase I Conveyance Pipe
- Possible Groundwater Treatment Facility Location (Not to Scale)

Notes:

1. Contour interval is 10 feet.
2. This figure shows conceptual layout and is not intended to depict engineering design.

0 600 1200
Scale in Feet

N

EAL 12/19/11 476916ROD-013.dwg

Source: Prepared from AutoCAD file "Alt 13M Contingent.dwg", created by URS, 06/24/09.

HARTCROWSER
4769-16 *12/11*
Figure 18
ROD

APPENDIX A
SUBSTANTIVE NATIONAL HISTORIC PRESERVATION ACT (NHPA) MEASURES

APPENDIX A
SUBSTANTIVE NATIONAL HISTORIC PRESERVATION ACT (NHPA) MEASURES

In General

For areas neither surveyed as part of the Forest Archaeologist's April 2011 Holden Mine Remediation NHPA Section 106 Report, nor covered by other Section 106 consultation reports for undertakings within the area of potential effect, a qualified archaeologist will conduct reconnaissance level cultural surveys of the areas to be disturbed as part of remedy design, construction, and infrastructure support. An archaeologist meeting NPS professional qualifications, and approved by the Remediation Project Manager (RPM), will conduct these surveys, which will be documented in Section 106 reports reviewed and signed by the Forest Archaeologist. Section 106 reports will be prepared for undertakings within previously surveyed areas only when previous Section 106 consultation has not been covered by the activity/undertaking. The RPM may require additional detailed cultural surveys based on archaeologist reports and recommendations. Any and all remedy design, construction, and infrastructure support activities within the boundary of the National Register eligible Holden Mine Historic District will constitute an adverse effect, and mitigation will be in accordance with this appendix.

Mitigation measures include the following:

a. Following remediation, install up to five interpretive signs about Holden Mine and each component of the Historic District throughout the Historic District, including Lucerne Bar. The signs will impart the history of the mine through the use of text and historical photographs. Estimated design, production, and installation costs range from $500 to $1,000 per sign.

b. Place an interpretive display and brochure about the mine and its cleanup at the Holden Mine Museum or another location in or near the Historic District. The cost for display and brochure design and production would range from $1,000 to $5,000.

c. Individuals with knowledge of the mine and its cleanup (such as Holden Village, Intalco, and Forest Service personnel) will make at least one public presentation/talk about the mine and cleanup annually for at least 7 years at Holden Village. The annual cost for preparing the presentation plus transportation and per diem for the presenter might be in the range of

$1,000 to $2,000. However, it is likely that the presenter would be on site for other purposes, thus reducing the cost.

d. Interpretive hikes led by knowledgeable personnel, such as from the Forest Service, Holden Village, and Intalco, through the Historic District, when those individuals are otherwise at Holden Village. The cost for preparing the presentation would be in the range of $1,000 to $2,000 annually.

e. Interpretive talks/presentations by knowledgeable personnel, such as from the Forest Service, Holden Village, and Intalco, aboard the Lady of the Lake boat (when those individuals are otherwise on the boat). The Lady of the Lake transports tourists and locals on Lake Chelan. In addition, to the extent the Forest Service otherwise provides interpreters on the boat, the Forest Service will provide those interpreters with information about the Historic District and the cleanup for use by the interpreters. The cost of preparing interpretive materials and presenting it would be in the range of $1,000 to $2,000 annually.

f. Document the Mill Building and any other buildings/structures slated for removal or demolition to Historic American Buildings Survey/Historic American Engineering Record (HABS-HAER) standards.

g. The Agencies will consider the feasibility of safely salvaging and later displaying key elements of the mill, such as the ore bin, grizzly, and mine train. The Agencies will also explore with Holden Village the possibility of incorporating architectural design elements of the mill into a dedicated museum space at Holden Village and the addition of displays, brochures, and interpretive panels to document the mill structure and operations.

h. During remedial design and remediation construction, the Washington State Historic Preservation Officer (SHPO) shall receive the monthly progress report. The SHPO shall also receive an annual report for 5 years following completion of the remedial action documenting mitigation measure implementation.

Specific Areas of Sensitivity

Under the Selected Remedy, remedy design, construction, and infrastructure support components of the Holden Mine Historic District will not affect Honeymoon Heights, Winston, and Holden Village Town Site. However, should there be changes during remedial design, Section 106 consultation will be needed as follows:

Winston Family Camp/Town Site and Honeymoon Heights Camp/Town Site. Cultural resource surveys and possible data recovery performed by a qualified archaeologist (approved by the RPM) is required if, based on the remedial design, remedy implementation would result in surface disturbances beyond the limits of the existing road systems through the Winston and Honeymoon Heights town sites or if the existing road systems are improved (graded, widened, or excavated).

Holden Village Town Site. While the structures and facilities comprising Holden Village are private property, these structures and facilities are located on National Forest System lands administered by the Okanogan-Wenatchee National Forest under a Special Use Permit as an interdenominational Retreat Center. The Selected Remedy does not provide for remediation activities in Holden Village that will affect historic features of the town site.

Forest Service Site 06170200131 (45CH820) (Winston Peeled Cedars). This is a pre-contact/indigenous archaeological site located within the boundary of the Holden Mine Historic District. Currently, the Selected Remedy does not provide for remediation activities that would affect this archaeological site. If remedial design changes and this archaeological site cannot be avoided, a qualified archaeologist will develop a treatment plan.

Discovery of Unanticipated Archaeological Resources, Human Remains, and Unanticipated Effects on Historic Properties

The National Register-eligible Holden Mine Historic District has been extensively inventoried for archaeological resources. Thus, continuous monitoring by a qualified archaeologist during ground-disturbing activities within the boundary of the Historic District is not required. However, in a landscape littered with historic mining debris, the potential for discovery of archaeological features and artifacts during remediation remains high. The discovery of human remains in this setting is unlikely, but must be acknowledged as a possibility. The protocol for the discovery of unanticipated archaeological resources, human remains, and/or unanticipated effects on historic properties identified within the area of potential effect shall be as follows:

1. With the exception of broken, crushed, or deteriorated historic mining artifacts, archaeological resource(s), including undocumented structural

features, shall be protected from project activities, and the RPM and Forest Archaeologist will be notified immediately.

2. A professional archaeologist shall inspect, document, and assess the significance of the find as soon as practical.

3. Commence consultation and evaluation of the significance of the find with the Washington SHPO and other interested parties, as appropriate.

4. If the discovery is considered significant, develop a treatment plan that takes into account the CERCLA remediation implementation schedule.

L:\Jobs\476916\ROD\Holden ROD Final January 2012.doc

RECORD OF DECISION

PART 3

THE HOLDEN MINE SITE
CHELAN COUNTY, WASHINGTON

JANUARY 2012

PREPARED BY
USDA FOREST SERVICE
WENATCHEE, WASHINGTON

IN COOPERATION WITH
US ENVIRONMENTAL PROTECTION AGENCY AND
THE WASHINGTON STATE DEPARTMENT OF ECOLOGY

PART 3 - RESPONSIVENESS SUMMARY

Note: Many of the comments on the Proposed Plan were framed as comments relating to MTCA. Similar to other provisions of state law, certain provisions of MTCA are applicable requirements (ARARs) for the Selected Remedy. Further, MTCA is being implemented independently at this Site by the Washington State Department of Ecology. Thus, for the purposes of the state's action, the Agencies have responded to comments in this document even where MTCA requirements are not ARARs for the CERCLA remedial action.

Comment and Response: 2-1

Comment:

The commenter disagrees with the Agencies conclusion that Alternative 13M does not constitute all known available and reasonable methods of treatment (AKART) because it does not include containment of groundwater downstream of Tailings Piles 2 and 3.

The commenter believes that Alternative 13M satisfies AKART. Based on a loading analysis provided by URS in February 2010, the commenter said that Alternative 13M has a high likelihood of reducing contaminant concentrations in Railroad Creek east of Tailings Pile 3 without the Phase 2 barrier wall around Tailings Piles 2 and 3. The commenter states that it would be illogical to conclude that a remedy (i.e., Alternative 13M) that is proven to be protective is insufficient. Given the comparable environmental benefits provided by Alternative 13M and 14, there is no justification for the Agencies' statement that Alternative 13M would not satisfy AKART.

The commenter further states that if Alternative 13M (or Phase 1 of the Proposed Plan) will result in protecting Railroad Creek and attaining applicable or relevant and appropriate requirements (ARARs), then the barrier around Tailings Piles 2 and 3 would be unnecessary.

Response:

The loading analysis for Alternative 13M does not indicate that Alternative 13M will be effective in eliminating water quality exceedances in groundwater, which is a necessary part of the remedy (i.e., meeting ARARs). The loading analysis was based on samples collected within the surface water that represent a mixed condition, not groundwater concentrations that discharge into the surface water. Alternative 13M does not constitute AKART since it has not been proven protective, and a proven, protective, and reasonable technology (the barrier wall) is available to be employed.

There is no information that shows that cleanup levels, including those based on protection of surface water, would be met in groundwater before it enters Railroad Creek downstream of Tailings Piles 2 and 3, without a barrier wall. Intalco has not shown how groundwater concentrations may be attenuating downgradient of Tailings Piles 2 and 3, or whether such attenuation is adequately protective of Railroad Creek. Therefore, the "comparable environmental benefit" referred to in the comment is not true since it is based on a flawed analysis.

In addition, contamination under Tailings Piles 2 and 3 exceeds MCLs. In accordance with CERCLA Section 121(d)(2)(A) [42 U.S.C. § 9621(d)(2)(A)], and the NCP, groundwater at the Site must be restored to meet MCLs – MCLs are relevant and appropriate requirements at this Site. The NCP provides that groundwater will be returned to its beneficial uses (including MCLs) within a reasonable restoration time frame wherever practicable [40 C.F.R. § 300.430(a)(1)(iii)(F)]. Although the point of compliance for groundwater cleanup under CERCLA is generally throughout the contaminated plume, the NCP recognizes that remedies may involve areas where waste materials will be managed in place. Such areas are referred to as waste management areas (WMAs).

Certain groundwater source areas at the Site, including Tailings Piles 2 and 3, if contained or managed, can be considered WMAs. This is because available information indicates that it will be hundreds of years before groundwater below the tailings and waste rock piles achieves cleanup levels (see Appendix E of the DFFS, URS 2004). Also, during the development of alternatives, relocation of the tailings piles and waste rock piles was not found to be practicable. Because no alternative was identified that could clean up groundwater beneath the tailings piles and waste rock piles, the tailings piles and waste rock piles will continue to serve as a source of contamination to groundwater [see Section 3.1 of the SFS (Forest Service 2007) for a discussion of why source depletion is not an acceptable alternative]. When restoration of groundwater is not practicable, it is necessary to prevent further migration of the plume and to prevent exposure to the contaminated groundwater [40 C.F.R. § 300.430(a)(1)(iii)(F)]. Thus, groundwater containment is a necessary aspect of a WMA so that contaminants do not migrate.

The Agencies identified on-site WMAs to address non-attainment of potential groundwater ARARs within the WMAs, see Section 2.5 of the ASFS (Forest Service 2010a). The Site WMAs are shown in the ROD on Figure 14. As long as groundwater is managed, the point at which groundwater must achieve cleanup levels is at and beyond the edge of the WMA (55 Fed. Reg. 8753, and 53 Fed. Reg. 51426). Without containment, MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3, or there would need to be an ARAR waiver for MCLs based on technical impracticability from an engineering perspective, which, if justified, would require a ROD Amendment. Such an ARAR waiver would not be approved unless the remedy was shown to be protective, including the protection of aquatic life where groundwater discharges to surface water, and institutional controls to prevent use of groundwater for drinking water below the tailings piles.

The Selected Remedy will contain and capture the groundwater within the WMAs. With the barrier and thus, the WMA, groundwater must achieve MCLs at and beyond the edge of the WMA (55 Fed. Reg. 8753, and 53 Fed. Reg. 51426) rather than throughout the plume. Thus, containment at Tailings Piles 2 and 3 is necessary to both prevent migration of the groundwater contamination that exceeds MCLs and to prevent groundwater from discharging to surface water above levels protective of receptors including aquatic life.

Unique comment(s) addressed:
TGAR01-18/20/21, INTA01-12/22/25

Comment and Response: 2-2

Comment:
The commenter states that, from a regulatory perspective, Alternative 13M constitutes AKART because, under MTCA, "practicability" takes costs into account and the "incremental costs" of the Tailings Pile 2 and 3 barrier wall proposed by the Agencies are "disproportionate to the incremental degree of benefits provided by the alternative over lower cost alternatives." WAC 173-340-200. The commenter states that the Agencies' position disregards the concepts of "practicability" and "reasonable cost."

Another commenter presents a similar argument and adds that the additional costs and the short-term risks associated with the Tailings Pile 2 and 3 groundwater barrier and collection system are disproportionate given the absence of any incremental environmental benefits.

Intalco estimates that the wall along Tailings Piles 2 and 3 would cost $15,730,000 and argues that this incremental additional cost is disproportionate to the expected environmental benefit.

Response:
Alternative 13M costs less than the Selected Remedy because it omits remedy components necessary to satisfy the threshold criteria under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Washington State's Model Toxic Control Act (MTCA). Alternative 13M does not meet CERCLA or MTCA threshold criteria including protection of human health and the environment and compliance with ARARs/cleanup standards. Under Alternative 13M, the risk to terrestrial receptors from materials in the Lower West Area, Honeymoon Heights Waste Rock Piles, DSHH, Holden Village, and the Wind-Blown Tailings Area would not be addressed except by monitoring. There is considerable uncertainty about whether proposed surface water cleanup levels would be met in groundwater before it enters Railroad Creek downstream from Tailings Piles 2 and 3, and Alternative 13M may not meet chemical-specific ARARs for surface water as discussed in the Addendum to the Supplemental Feasibility Study (ASFS) Sections 6.2.2.1 and 6.2.2.2.1. In addition, without the barrier at Tailings Piles 2 and 3, Alternative 13M does not qualify for a WMA in that area, and must meet MCLs throughout the groundwater under Tailings Piles 2 and 3.

Under MTCA, a disproportionate cost analysis is a criterion for evaluating only those remedial alternatives that satisfy the threshold criteria to determine that a remedial alternative is permanent to the maximum extent practicable.

For purposes of MTCA, Ecology disagrees with the assertion that the incremental environmental benefit of the Selected Alternative is disproportionate with the incremental cost. Under Alternative 13M, without the Tailings Pile 2 and 3 groundwater barrier, contaminated groundwater from beneath the tailings piles would continue to discharge untreated into Railroad Creek at concentrations up to several orders of magnitude greater than surface water cleanup levels as illustrated on Figures 6 and 8 of the Proposed Plan and Figures10 and 11 in the ROD.

Unique comment(s) addressed:
TGAR01-23/38a/38b/38c/38d, INTA01-13/19/22/25, URSC07-09

Comment and Response: 2-3

Comment:
The commenter states that Alternative 13M is expected to be protective of Railroad Creek and meet ARARs in a reasonable restoration time frame. Natural attenuation, in conjunction with all the other source control measures included in Alternative 13M, should be treated as a viable technology for meeting the cleanup goals in a reasonable time frame. Therefore, Alternative 13M should be considered to satisfy AKART.

The commenter states that the Agencies concluded that natural attenuation is not a suitable alternative to physical containment or hydraulic isolation of groundwater. Alternative 13M includes several other source control measures and, therefore, does not rely on natural attenuation.

Response:
Information collected during the RI/FS does not show that Alternative 13M active measures combined with natural attenuation would eliminate the release of hazardous substances from Tailings Piles 2 and 3 into Railroad Creek, or that Alternative 13M would be protective within any specific time frame. Without the groundwater barrier downgradient of Tailings Piles 2 and 3, hazardous substances would continue to be released and cause exceedances of aquatic life criteria in groundwater that discharges to surface water such as Railroad Creek and the wetlands east of Tailings Pile 3.

Acid rock drainage occurring at the Site will continue to release hazardous substances until the sources of contamination (the mine, tailings, and waste rock piles) are depleted over hundreds of years. Alternative 13M included control of some, but not all, of these sources. Natural attenuation may be an acceptable mechanism to address groundwater that is already contaminated, but is not acceptable as a source control method. The final Feasibility Study did not show that groundwater concentrations would sufficiently attenuate naturally downgradient of Tailings Piles 2 and 3, or whether such natural attenuation would occur within a reasonable restoration time frame to be protective of Railroad Creek.

In addition, without the barrier at Tailings Piles 2 and 3, Alternative 13M does not qualify for a WMA in that area and must meet MCLs throughout the groundwater under Tailings Piles 2 and 3. Without containment, there would not be a WMA, and MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3, or there would need to be an ARAR waiver for MCLs in groundwater beneath the tailings piles based on technical impracticability from an engineering perspective, which, if justified, would require a ROD Amendment. Such an ARAR waiver would not be approved unless the remedy was shown to be protective, including the protection of aquatic life where groundwater discharges to surface water, and the establishment of institutional controls to prevent use of groundwater for drinking water below the tailings piles.

Unique comment(s) addressed:
MWHA01-27/33/38, INTA01-22, TGAR01-38

<u>Comment and Response: 2-4</u>

Comment:
Source control does not require containment and can take other forms, such as stabilization.

Response:
The comment is correct, but the final Feasibility Study did not find that stabilization would effectively prevent the release of hazardous substances from the tailings and waste rock piles.

Unique comment(s) addressed:
TGAR01-38e

Comment and Response: 2-5

Comment:
The commenter states that Alternative 13M satisfies AKART in the area east of Copper Creek with upgradient source controls (i.e., diversion of surface water run-on due to precipitation), regrading, revegetation, and preventing the release of tailings to Railroad Creek. In addition, Alternative 13M satisfies AKART in the area west of Copper Creek with upgradient source controls (diversion of run-on), source removal, a groundwater barrier to facilitate collection and treatment, and through the natural attenuation of metals loading in both areas.

Response:
Under Alternative 13M, untreated groundwater from beneath Tailings Pile 3 and at least part of Tailings Pile 2 would continue to discharge into Railroad Creek at levels exceeding surface water quality standards (ARARs). Intalco suggests that groundwater from Tailings Piles 2 and 3 may meet proposed surface water cleanup levels where it discharges into Railroad Creek at some unspecified future time, but has not demonstrated how or when this will occur. Alternative 13M does not constitute AKART since it does not contain and collect all groundwater above cleanup levels for treatment before it discharges to surface water, while the containment barrier wall used in the Selected Remedy has been determined to satisfy AKART for the tailings piles on both the east and west sides of Copper Creek (see Section 6.3.1.1 of the ASFS).

Alternative 13M may not satisfy AKART in the area east of Copper Creek depending on the outcome of groundwater monitoring downslope from Honeymoon Heights, which is included in the Selected Remedy.

In addition, Alternative 13M does not meet threshold criteria. MCLs are ARARs in groundwater and must be met throughout the Site unless there is a WMA or an ARAR waiver. Without the barrier at Tailings Piles 2 and 3, Alternative 13M does not qualify for a WMA in that area and must meet MCLs throughout the groundwater under Tailings Piles 2 and 3.

Unique comment(s) addressed:
TGAR01-39, MWHA01-28/33, INTA01-12/19

Comment and Response: 2-6

Comment:
Commenter states that Intalco reserves its position that AKART should not be required as a condition for obtaining a conditional point of compliance.

Response:
Under MTCA, AKART is a prerequisite for a conditional point of compliance, as follows:

- Ecology may approve a conditional point of compliance where "...the person responsible for undertaking the cleanup action shall demonstrate that all practicable methods of treatment are to be used in the site cleanup." WAC 173-340-720(8)(c).

- Ecology may approve a conditional point of compliance subject to conditions including "Groundwater discharges shall be provided with all known available and reasonable methods of treatment before being released into surface waters." WAC 173-340-720(8)(d)(i)(D).

Unique comment(s) addressed:
INTA01-12

<u>Comment and Response: 2-7</u>

Comment:
Definitive statements in the Proposed Plan about the failure of Alternative 13M to meet AKART are at best premature since the contingent remedy component indicates uncertainty whether the Phase 2 barrier is needed to meet ARARs.

Response:
First, ARARs include MCLs which must be met in groundwater under Tailings Piles 2 and 3 absent containment, such as a barrier wall, and a WMA.

Information collected during the RI/FS does not show that the Alternative 13M combination of active measures and natural attenuation would reduce groundwater contamination to below MCLs, or eliminate the release of hazardous substances above cleanup levels from Tailings Piles 2 and 3 into Railroad Creek, or that Alternative 13M would be protective within any specific or reasonable time frame. The groundwater barrier is a proven technology that will eliminate this release, thus it complies with AKART under MTCA's requirement. Without the groundwater barrier downgradient of Tailings Piles 2 and 3, hazardous substances would continue to be released and cause exceedances of aquatic life criteria in groundwater that discharges to surface water, including Railroad Creek and the wetlands east of Tailings Pile 3.

Unique comment(s) addressed:
HVWC02-12a

<u>Comment and Response: 4-1</u>

Comment:
The commenter suggests that "all practicable methods of treatment" means those demonstrated to work under similar circumstances and applicable to the Site at a reasonable cost. Construction and performance of barrier walls in excess of 100 feet deep in challenging soil similar to the Holden Mine Site are not well documented. The barrier wall along Tailings Pile 2 and 3 has not been demonstrated to work under similar site conditions and is not practicable or reasonable.

A second commenter states that the Agencies have done no analysis of whether the Phase 2 wall would constitute "reasonable" level of treatment under the circumstances presented at the Site.

Response:
As discussed in Appendix C of the Supplemental Feasibility Study (SFS) (USFS 2007), the Agencies conducted an extensive literature review to document the success of groundwater barrier walls installed in combination with groundwater collection systems at more than a hundred sites over the past 25+ years as part of containment and remediation systems.

Groundwater barrier walls have been successfully constructed to depths comparable to and greater than anticipated at the Site, in similar alluvial and glacial soils with cobbles and boulders (Davidson et al. 1992, Koelling et al. 1997, McMahon et al. 1994, Thompson et al. 1997, and Recon-net 2005) and on steep slopes (Stamnes et al. 1997). The deeper barriers that were researched by the Agencies ranged in depths of up to 80 to 230 feet. Please refer to the SFS for additional details about the example barrier walls constructed in soils and at depths that are similar to those anticipated at the Site.

Based on a large number of sites where barrier walls have been successfully used to contain groundwater as part of remedial actions, the Agencies conclude this technology would be reasonably effective as part of a cleanup action at the Holden Site and implementable along Tailings Piles 2 and 3.

Unique comment(s) addressed:
MWHA01-22, HVWC02-12b

Comment and Response: 4-2

Comment:
The commenter states that a barrier wall along Tailings Piles 2 and 3 is not needed and asserts that the actions included under Alternative 13M satisfy AKART for groundwater along Tailings Piles 2 and 3 and meet CERCLA and MTCA criteria for remedy selection.

Another commenter asserts that Alternative 13M is: 1) sufficiently protective without a groundwater barrier downgradient of Tailings Piles 2 and 3; 2) more implementable; 3) less costly; 4) would cause less disruption to Holden Village; 5) has fewer environmental impacts; and 6) will meet ARARs at a conditional point of compliance in Railroad Creek.

Response:
Alternative 13M does not satisfy the CERCLA or MTCA criteria for remedy selection.

Alternative 13M does not constitute AKART since it has not been proven protective and other, more protective, measures are available and satisfy AKART to prevent adverse impacts to surface water receptors (see Section 6.3.1.1 of the ASFS).

The Agencies disagree with the commenter's conclusions and respond to the six listed points as follows:

1. First, ARARs include MCLs that must be met in groundwater under Tailings Piles 2 and 3 absent a barrier wall and WMA. The final Feasibility Study did not demonstrate that proposed cleanup levels (ARARs), would be met in groundwater under Tailings Piles 2 and 3 or before it enters Railroad Creek downstream of Tailings Piles 2 and 3 without a barrier wall.

2. Based on the large number of sites where groundwater barrier walls have been successfully used to contain groundwater as part of remedial actions, the Agencies consider a groundwater barrier wall along Tailings Piles 2 and 3 to be well within standard construction practice and, therefore, implementable.

3. Under both CERCLA and MTCA, cost is irrelevant unless the threshold criteria are met. For the purposes of MTCA, Ecology disagrees with the conclusion that the incremental environmental benefit is disproportionate with the estimated cost. Without the barrier wall along Tailings Piles 2 and 3, contaminated groundwater from beneath Tailings Pile 3 and at least part of Tailings Pile 2 would continue to discharge untreated into Railroad Creek under Alternative 13M for an unacceptable amount of time at levels that do not meet surface water quality standards (ARARs).

4. The Selected Remedy will be constructed in two phases to reduce the impact of construction on Holden Village.

5. Risks associated with construction activity could be adequately mitigated through implementation of best management practices (BMPs) and Spill Prevention, Control, and Countermeasures (SPCC) plans.

6. As stated above, MCLs will not be met under Tailings Piles 2 and 3 with Alternative 13M. The conclusion that Alternative 13M will meet ARARs at MTCA's conditional point of compliance (conditional POC), or the relevant point of compliance established under CERCLA, is based on flawed analyses and insufficient information.

   a. Specifically, the results from Intalco's loading analyses do not represent concentrations of hazardous substances at the relevant point of compliance for groundwater releases to surface water. The loading analysis provided by URS in February 2010 was based on diluted samples collected within the surface water. Under MTCA, these samples do not indicate cleanup can be accomplished "as close as practicable to the source of hazardous substances," as required in WAC 173-340-720(8)(c). The use of a groundwater barrier does make it practicable, under MTCA, to achieve groundwater cleanup criteria at a point within the groundwater before entering the surface water, within a reasonable restoration time frame. The criteria for a conditional POC under WAC 173-340-720(8)(d)(i), therefore, are not triggered.

   b. Intalco has not shown the extent or the mechanism for attenuating groundwater concentrations downgradient of Tailings Piles 2 and 3, and whether such attenuation is adequately protective of Railroad Creek.

Unique comment(s) addressed:
INTA01-13

Comment and Response: 5-1

Comment:
The commenter does not support Alternative 11M because it would cause a *hardship for Holden Village due to the apparent length of construction.*

Response:
The Agencies understand that there are concerns about the impact of remedial construction on Holden Village and are working with the Village in an effort to reduce the potential impacts of

construction. The Selected Remedy incorporates construction phasing that was described in the Proposed Plan for Alternative 14. As stated in Section 10.1 of the Proposed Plan, Alternatives 11M and 14 differ in their ability to satisfy some of the primary balancing criteria used for remedy selection under CERCLA. Overall, Alternative 14 provides a better balance among all the criteria, which is why it was presented (and not Alternative 11M) as the preferred alternative in the Proposed Plan, and why this phased approach was adopted for the Selected Remedy. While the Agencies cannot guarantee major construction for the first phase of the remedy will be completed in two years, (for example, delays could arise due to a forest fire or other circumstances beyond anyone's control) the Agencies will continue to work with Holden Village to reduce the potential impacts of construction.

Unique comment(s) addressed:
PHIN01-04, TANE01-03, DGWI01-02

Comment and Response: 6-1

Comment:
The comment writer supports Alternative 11M as the only alternative to clean up the environment properly and comprehensively. The writer expressed the opinion that it is important to take the time and care needed to provide the most comprehensive cleanup possible, in order to "get it right" for future generations.

Response:
As stated in Section 10.1 of the Proposed Plan, Alternatives 11M and 14 both satisfy the threshold criteria for selection of a remedy under CERCLA and MTCA but differ in their ability to satisfy some of the primary balancing criteria. The Agencies believe the advantages of Alternative 11M are more than offset by the advantages of Alternative 14 and that, on balance, Alternative 14 is the better alternative. See Section 10 of the Proposed Plan for details about the advantages of Alternative 14 compared to Alternative 11M. When fully implemented, the Selected Remedy, which was based on Alternative 14, will satisfy all the requirements for a final remedy including those for a permanent remedy under MTCA.

Unique comment(s) addressed:
AWER01-01, BBAR01-01, MBAR01-01, PFEN02-01, TPHA01-01, TPHA02-01

Comment and Response: 7-2

Comment:
It is unclear when the groundwater containment barriers around Tailings Piles 1, 2, and 3 would be built. Given their expense and extreme compromise to the Holden Village viewshed, these should be postponed to Phase 2, or indefinitely, after reviewing 3 years of data after Phase 1.

Response:
The groundwater barriers would not significantly change the visual character of the Railroad Creek valley because they would be constructed entirely below the ground surface. The only visible manifestation of the barriers that would remain following construction would be embankments located along the barrier alignments between the tailings piles and Railroad Creek. These

embankments are expected to be generally less than 10 feet high and are needed to construct the barriers and to help with access and maintenance once the barriers are complete.

Existing data demonstrate that groundwater above cleanup levels must be contained both to meet requirements for groundwater remediation and to protect aquatic life in Railroad Creek. Therefore, the groundwater barrier around the Tailings Pile 1 and the Lower West Area would be constructed during Phase 1 of the Selected Remedy. The groundwater barrier around Tailings Piles 2 and 3 would be constructed during Phase 2 of the Selected Remedy, which is anticipated to begin 5 years after completion of the first phase. Delaying the construction of the second phase barrier wall to reduce the impact of construction on Holden Village, will increase both the cost of remediation and the length of time before aquatic life in Railroad Creek is protected.

Section 4.3 of the ROD sets forth the conditions for evaluating whether the Phase 2 groundwater barrier wall containment approach may be modified based on an evaluation of the results achieved following the implementation of Phase 1 remedy components. To date, available data show that the groundwater barrier will be needed to protect Railroad Creek and to achieve groundwater ARARs.

Unique comment(s) addressed:
HBMC02-05

Comment and Response: 7-3

Comment:
The map from the public meeting shows the Lucerne to Holden road passing under Ten Mile Creek. Is that not a bit unusual? Especially since it is outside the treatment area.

Response:
The map shows a symbol to indicate there is a bridge where the road crosses Tenmile Creek, which flows uninterrupted under the road. The Tenmile Creek Bridge will remain, though it will need to be determined during design whether upgrades to the bridge are necessary to handle remedy construction-related traffic.

Unique comment(s) addressed:
SGWE01-01

Comment and Response: 7-4

Comment:
What's the rationale for not doing the groundwater barrier around the full site, meaning all the tailings piles? Is one by far the more primal cause of all the problems? What were the primal reasons to split it into two phases?

Response:
The Selected Remedy will contain groundwater that exceeds MCLs and will address all the existing groundwater discharges that exceed cleanup levels to surface water adjacent to the former mine. Although information collected in the RI/FS shows that groundwater below all the tailings piles is above MCLs and is a source of hazardous substances into Railroad Creek, the Agencies decided to

implement the remedy in two phases solely to reduce the impact of construction on residents and operations of Holden Village.

The first phase of remedial construction will include collection and treatment of the drainage from the mine portal, as well as a considerable amount of groundwater impacted by the tailings and waste rock piles. The second phase of remedial construction will address the remainder of the groundwater impacted by hazardous substances from the tailings piles.

In addition, Intalco has suggested that natural attenuation is ongoing, and that this, along with the anticipated benefits of first phase of the remedy will, over time, eliminate the need for the second phase groundwater barrier wall around Tailings Piles 2 and 3. Although this opinion is not supported by existing data, in the future the Agencies may modify the remedy if new data collected by Intalco show that the containment, as represented by the second phase groundwater barrier system could be modified, as discussed in Section 4.3 of the ROD.

Unique comment(s) addressed:
WPQA01-07

Comment and Response: 8-1

Comment:
The comment writer supports the selection of Alternative 14 as the preferred alternative, since it will reduce the impact of construction on Holden Village.

Response:
Comment noted. Thank you for your support.

Unique comment(s) addressed:
BGAM01-01, CCAL01-01, CGIE01-01, CJOH01-02, CKAI01-01, CKER01-01, CWAG01-01, DGWI01-01, DJOH01-01, DMES01-01, DMFA01-04, DPET02-01, EJMA01-01, EREE01-02, FFEN01-01, FPOS01-01, HBMC01-01, HOGR01-01, JNES01-01, JSMI01-02, JSTA01-02, MALL01-01, MTLU01-01, MWAG01-02, NMAT01-01, NSCH01-01, OMAT01-04, PCPE01-01, PFEN01-01, PHIN01-03, PISE01-02, PTEL01-03, RCTR01-01, RPON01-01, SKRA01-01, THBR01-01, TPER01-01, TPER02-03, TSMI01-01

Comment and Response: 9-1

Comment:
Some references cited by the Agencies in their comments to Intalco documents regarding the extent of habitat in the hyporheic zone are inappropriate because these studies were conducted on rivers that are not analogous to Railroad Creek (in particular, the study conducted on the Flathead River).

Response:
Data on surrogate environmental receptors and experience at other sites are often used in developing the rationale for environmental cleanup in the absence of site-specific data. Generally the Agencies concur that site-specific data should be considered to the extent possible. In this case, the Agencies cited studies from the Flathead River as an analog to Railroad Creek because the RI/FS

does not provide any comparable data for hyporheic receptors in Railroad Creek. Reference to this information does not change any of the reasons for choosing the Selected Remedy.

Unique comment(s) addressed:
HVWC03-04

Comment and Response: 9-2

Comment:
The comment writer is concerned that iron impacts to macroinvertebrates need to be evaluated.

Response:
Benthic macroinvertebrates in Railroad Creek were evaluated and the data indicate adverse impacts to the stream invertebrates from the release of iron from the former mining activities adjacent to Railroad Creek. This includes impacts from hazardous substances in iron floc that forms where groundwater seeps into Railroad Creek, as well as ferricrete that adversely impacts the stream channel substrate. Information on the impacts to the macroinvertebrates is provided in the Remedial Investigation. See also the report prepared for USDA Forest Service titled "HEA Calculations for the Holden Mine Site, Chelan County, North Central Washington State, April 15, 2005." Figure 3.5 in that report provides a summary of invertebrate data at various locations in Railroad Creek. The figure clearly shows the density or frequency of occurrence of total invertebrates, and specifically mayflies, is much lower adjacent to and downstream of the mine compared to reference reaches upstream of the mine.

Unique comment(s) addressed:
WDAL02-02

Comment and Response: 10-1

Comment:
The Agencies improperly identified numerous other regulations as ARARs. Also the Agencies have not clearly explained ARARs, how they apply to the Proposed Plan, how ARARs provided a basis for developing proposed alternatives and how the Proposed Plan meets an ARAR requirement.

Response:
A CERCLA remedial action must meet ARARs, subject to possible waiver under limited circumstances. 42 U.S.C. § 9621(d). ARARs include any standard, requirement, criteria, or limitation under federal environmental law, or any promulgated standard, requirement, criteria, or limitation under a state environmental or facility siting law that is more stringent than any federal standard. 40 C.F.R. § 300.5. To properly evaluate alternatives, the RI/FS identified potential ARARs that would or might apply to the circumstances at the Site and the remedy components under consideration.

The identification of appropriate ARARs other criteria, advisories, or guidance to be considered (TBCs) started early in the RI/FS process; see, for example, Dames and Moore (1999) and Forest Service (2000). The outcome of the ARAR identification process is documented in Section 13.2 of the ROD, which presents 42 ARARS and 15 TBCs for this remedial action. The scope and relevance of these ARARs and TBCs for the Holden Site is discussed in Tables 16 through 19 of the ROD, Section 6.2 of the Proposed Plan, and Appendix D of the Addendum to the Supplemental Feasibility Study. Additional details on how the Selected Alternative will meet ARARs will be developed during Remedial Design (e.g., design of the new Railroad Creek channel) but the requirements that need to be satisfied are clear [e.g., the Hydraulic Code (RCW 77.55; Chapter 220-110 WAC)].

Proposed ARARs were identified by the Agencies and discussed with Intalco before completion of the DRI (Forest Service 1999). As the RI/FS studies progressed, additional ARARs were identified based on the types of chemicals, locations, and remedial activities that they addressed. Potential ARARs and their relevance to different remedial alternatives was evaluated as part of the draft FS (URS 2002) and comments by the Agencies (Forest Service 2002b) and related correspondence (Forest Service 2003); the DFFS (URS 2004) and the Agency comments on the DFFS (Forest Service 2007a); the SFS (Forest Service 2007b); Alternative 9 (Covington and Burling 2005, and Forest Service 2007c); Alternative 13 (Covington and Burling, 2007, ERM and URS 2009, and Forest Service 2010b); and the ASFS (Forest Service 2010a); as well as in other correspondence between the Agencies and Intalco. Compliance with ARARs was an integral consideration in the remedy selection process.

The Record of Decision (ROD) presents the final ARARs and TBCs that the Selected Remedy must attain (except where waived). The Selected Remedy was evaluated under both CERCLA and MTCA criteria, and as described in Section 13.2 of the ROD, was evaluated for attainment of ARARs.

The Agencies appropriately identified potential ARARs during the RI/FS process and have described how the Selected Remedy satisfies ARARs. The ARARs identified by the Agencies do not include other (non-ARAR) laws and regulations that must be complied with (e.g., HAZWOPER safety regulations Chapter 296-843 WAC).

Unique comment(s) addressed:
TGAR01-56c, INTA01-62, TGAR01-56, TGAR01-56a, TGAR01-56b, TGAR01-56d, TGAR01-56e

Comment and Response: 10-2

Comment:
Concern was expressed that ARARs were not defined with meaningful specificity using the example of identifying all of MTCA as an ARAR.

Response:
EPA guidance indicates the Proposed Plan should present a summary of ARARs, and more detail is to be provided in the Feasibility Study and the ROD (EPA-540-R98-031). The NCP requires that ARARs be identified in accordance with criteria that are presented at 40 C.F.R. § 300.400(g). Each ARAR and TBC, including citations to the statute or regulation, (or in the case of TBCs, other advisories, criteria, or guidance) from which it is derived is presented in the final Feasibility Study documents, and the Proposed Plan, in conformance with 40 C.F.R. § 300.400(g)(5). MTCA is the State of Washington's cleanup law and certain provisions (where more stringent) are applicable to the release and remedial action at the Site. Furthermore, the Holden cleanup is also a MTCA action under the state's independent jurisdiction.

Unique comment(s) addressed:
INTA01-56c

Comment and Response: 10-4

Comment:
The Proposed Plan did not explain ARARs and TBCs and makes it impossible for the plan to enable public participation required under CERCLA and MTCA.

Response:
Section 6.2 of the Proposed Plan explains what ARARs and TBCs are. Section 9.1 of the Proposed Plan presents an analysis of each alternative and whether an alternative that meets CERCLA and MTCA criteria for selection as a final remedy would comply with ARARs. This discussion is supported by numerous earlier discussions in the Administrative Record documents that address how various proposed remedial alternatives would or would not satisfy ARARs. The analysis includes chemical-, action-, and location-specific ARARs, as well as TBCs as required under CERCLA and MTCA. The information provided did in fact facilitate public participation and comment on all of the alternatives presented and the selection of the Preferred Alternative.

Unique comment(s) addressed:
TGAR01-56g

Comment and Response: 10-5

Comment:
The ASFS contains four pages of TBC criteria without explaining how each is to be considered at Holden Mine.

Response:
Appendix F of the ASFS does include a brief discussion of how each of the identified TBCs was used in developing and evaluating remedial alternatives. In the ASFS and Proposed Plan, potential TBCs are evaluated along with potential ARARs as part of the remedy selection conducted to achieve protective cleanup levels and goals. The TBCs are further discussed in the ROD (see Section 13.2 and Table 22).

Some of the TBCs were used to guide the selection of cleanup levels and for remedy selection. During the remedial design and implementation process, TBCs will be used to evaluate acceptability of components of the remedy.

Unique comment(s) addressed: TGAR01-56f

Comment and Response: 10-6 and 10-7

Comment:
There is no regulatory basis to prefer lined settling ponds. A liner is unwarranted because water in settling ponds will have been treated.

Response:
Treatment system ponds for the Selected Remedy must be lined to prevent infiltration of pond water that exceeds cleanup levels into the underlying groundwater. Preventing groundwater quality degradation that would otherwise occur from infiltration of water that exceeds cleanup standards is

required under Washington's water quality standards (WAC 173-200-030), MTCA [173-340-702(4)], as well as other ARARs. Furthermore, lined ponds are a standard requirement in the Washington Permit Writers Manual, which provides guidance information for all kinds of water treatment systems and has been selected as a TBC for the Selected Remedy. Under the Selected Remedy, groundwater treatment will involve adding an alkaline treatment agent to the influent water, which is typified by low pH and high total and dissolved metals concentrations. The influent will be mixed and oxidized, and discharged into treatment ponds where dissolved metals will react with components of the neutralizing agent and precipitate as metal hydroxide sludge. Water entering the pond will not be completely neutralized, and total and dissolved concentrations of hazardous substances are expected to diminish as flow proceeds through the pond(s). Depending on details of the treatment system that will be developed during Remedial Design, start-up, and/or following initial operation of the treatment system, it may be necessary to use multiple ponds for different stages of treatment to achieve water quality criteria in the effluent. Lined ponds are needed to prevent degradation of groundwater and nearby surface water quality from infiltration of incompletely treated water.

Unique comment(s) addressed:
TGAR01-61, TGAR01-61a

Comment and Response: 10-8 and 10-174

Comment:
Ecology's Permit Writers Handbook (sic) and the "Orange Book" are not ARARs or TBCs, because Ecology does not have delegated authority on federal land, the treatment system is not a sewage treatment works, and they were identified later than the early stages of the comparative analysis and not in a timely manner.

The use of the Permit Writer's Manual as a TBC requires further justification from Ecology because (municipal) wastewater discharge permit requirements are not ARARs.

Response:
In accordance with the NCP, in addition to ARARs, the Agencies may identify other federal or state advisories, criteria, or guidelines to be considered for a particular release. Such "To Be Considered" (TBC) standards may be useful in developing CERCLA remedies. See 40 C.F.R. § 300.400.

The issue of whether Ecology has delegated Clean Water Act authority on federal land at the Holden Mine Site is irrelevant, but in any event, Ecology does not concede any lack of authority.

The scope of the Permit Writer's Manual includes a range of applications where water is treated and discharged, and is not limited to sewage treatment works as indicated in the comment.

The comment is also incorrect in suggesting that the requirement to consider elements included in the Permit Writer's Manual were not identified in a timely manner. First, the CERCLA concept raised in this comment pertains to a state's timely identification of ARARs to the federal agency in the context of a federal-lead site. It does not pertain to the situation raised by this comment – i.e., timely informing a PRP.

For the benefit of clarification, however, the Agencies informed Intalco during the RI (Forest Service 1999) that discharges from the Site would need to comply with the substantive requirements of a State Waste Discharge permit, and other relevant and appropriate requirements. The current (2010) version of the Permit Writer's Manual provides guidance to Ecology and the other Agencies on procedures for implementing NPDES discharge requirements, evaluation of AKART, and other important technical issues that the remedy needs to address and that go beyond specific ARARs.

The groundwater treatment system that is part of the Selected Remedy, is not the same type of treatment system as is used for municipal wastewater (sewage) treatment. But the system has engineering design and operational components that are sufficiently similar to some of the design and operational components that are addressed in the Orange Book, that this document is also a TBC, and so will be used for remedy implementation.

It is appropriate to consider the Orange Book as a TBC because it falls within the TBC definition of advisories, criteria, or guidelines developed by EPA, other federal agencies, or states, that may be useful in developing CERCLA remedies. [40 C.F.R. § 300.400(g)(3)].

Unique comment(s) addressed:
TGAR01-61b, TGAR01-61c, TGAR01-61d, TGAR03-36

Comment and Response: 10-9 and 33-13

Comment:
One comment noted that groundwater beneath the tailings piles exceeds drinking water standards, but drinking water standards are met within a very short distance downgradient of the tailings piles. Groundwater in other areas of the Site also exceeds groundwater criteria. The comment asserted there is no reason to think that on-site groundwater sources exceeding drinking water standards would be used as a drinking water. Holden Village currently obtains drinking water from Copper Creek, which is unaffected by the Holden Mine. Holden Village is the only local community in need of drinking water.

A related comment asserted that Washington State's MCLs are not ARARs and State MCLs are not applicable or relevant and appropriate because groundwater at the Site is not a current public water supply or a potential source of drinking water and because non-groundwater drinking supplies in Railroad Creek valley are abundant.

Response:
Groundwater at the Site meets the definition of a potential groundwater source [WAC 173-340-720(2)] and, therefore, beneficial use for groundwater at the Site includes using it as a potential source of drinking water [WAC 173-340-720(1)(a)]. At Lucerne, which is downgradient of the mine facility, but included in the Site, groundwater is a current source of drinking water.

Primary Maximum Contaminant Levels (MCLs) under WAC 246-290-310 and the federal Safe Drinking Water Act (SDWA; 42 U.S.C. § 300f-j) are relevant and appropriate in accordance with CERCLA, 42 U.S.C. § 9621. WAC 173-340-720(1) directs that groundwater cleanup levels be based on protecting groundwater as a drinking water source, in addition to other requirements. The WMAs will be established once the barrier walls are installed and so that the MCLs may be met at the edge and beyond the WMA rather than throughout the plume. Other ARARs, in addition to the

MCLs, provided the primary basis for the Selected Remedy. The Remedy may need to be modified if future monitoring shows groundwater outside the WMAs exceeds the MCLs. The abundance of other sources of drinking water in the valley is not a consideration in determining beneficial uses of groundwater as determined under WAC 173-340-720, nor does it negate CERCLA's requirement to meet MCLs in groundwater.

The State of Washington has identified drinking water as the highest and best use for waters of the State. Regardless of whether it is currently used as a drinking water resource (and the Agencies note that groundwater is a source of drinking water at Lucerne which is part of the Site) Washington groundwater protection regulations require the protection of existing and future beneficial uses of the groundwater through the reduction or elimination of discharge of contaminants [See WAC 173-340-720(1) & (2); WAC 173-200-010; RCW 90.54.020(3)(b)].

The areal extent of groundwater exceeding drinking water standards outside the WMA boundary is very limited. The Agencies do not expect this issue to be a major driver in remedial design decisions.

Unique comment(s) addressed:
TGAR01-58, TGAR01-58a, TGAR01-58b, MWHA01-05

Comment and Response: 10-10

Comment:
The Washington Mining Reclamation regulations administered by DNR are more relevant and appropriate for the tailings and waste rock piles because they are tailored to mine sites. Alternative 13M satisfies the quoted requirements of DNR's reclamation plan.

Response:
ARARs for the Holden Mine were selected because they are applicable or relevant and appropriate to cleanup of the Site to prevent risk to human health and the environment. The DNR regulations are not intended to address the release of hazardous substances. The Washington DNR refers to "reclamation" as meaning rehabilitation of disturbed areas resulting from surface or underground mining. The basic objective of reclamation at mines is to reestablish the vegetative cover, soil stability, and water conditions at a site. As a second beneficial use, mines are reclaimed for fish and wildlife, grazing, forestry, wetlands, and commercial and industrial uses. The DNR reclamation regulations may be ARARs for restoration of disturbed areas of the Site, where these do not conflict with the Forest Plan and other ARARs. To the extent that the DNR reclamation regulations may be ARARs, where more than one ARAR may apply at a site, the more stringent ARAR is followed.

Since the DNR mining reclamation regulations are not ARARs that address the release of hazardous substances at the Site, whether Alternative 13M would satisfy the DNR requirements for mine reclamation, is irrelevant for selection of a remedy.

Unique comment(s) addressed:
TGAR01-51a, TGAR01-51b

Comment and Response: 10-11

Comment:

RAO #1 includes an inappropriate regulatory component by stating compliance with ARARs.

Response:

RAO number 1 is: "Reduce surface water concentrations of contaminants of concern to levels that are protective of aquatic life and comply with applicable, or relevant and appropriate requirements (ARARs) in Railroad Creek and other surface waters."

The inclusion of compliance with ARARs in Railroad Creek and other surface water in RAO #1 adds more specificity to the RAO than would a more general objective.

Compliance with ARARs is a CERCLA threshold criterion used to evaluate all alternatives in the Proposed Plan. Therefore, inclusion of ARARs in the RAOs simply helps to ensure that the remedy will achieve this threshold criterion. It is appropriate to include compliance with ARARs as a remedial action objective.

Unique comment(s) addressed:

TGAR01-54e

Comment and Response: 10-12

Comment:

Several comments mention RAO #2 and addressing ferricrete in Railroad Creek as an RAO. The comments are summarized as: RAO #2 is not an appropriate remedial action objective under CERCLA or MTCA and should be eliminated; ferricrete is not a hazardous substance, meaning this part of RAO #2 is of questionable validity; remediation of the release of metals that are hazardous substances under RAO #1 will eliminate ferricrete making this portion of RAO #2 unnecessary; and RAO #2 calls for elimination rather than reduction of adverse effects of ferricrete.

Response:

RAO number 2 is: "Eliminate the adverse effect of ferricrete to aquatic life in Railroad Creek and monitor sediment quality to determine whether any further action is needed to protect aquatic life and comply with ARARs."

The release of hazardous substances into groundwater and surface water resulted in the formation of ferricrete in Railroad Creek. The presence of ferricrete adversely impacts habitat for the benthic macroinvertebrates that sustain the creek's food chain. The elimination of hazardous concentrations of iron and aluminum releases into Railroad Creek will eliminate this adverse impact on this habitat and receptors, by eliminating future formation of ferricrete. Ferricrete forms as a direct result of the release of hazardous substances into the environment (Forest Service OGC 2006). It is entirely appropriate to have a remedial action objective to eliminate the ongoing adverse effect of ferricrete formation to aquatic life in Railroad Creek

Even if the first RAO is achieved (i.e., "Reduce surface water concentrations of hazardous substances...") this would not necessarily eliminate chemical reactions that cause ferricrete to be formed as groundwater is exposed to oxygen in surface water and mixing occurs. Further, reduction of elevated metals in surface water or groundwater does not address the continuation of the adverse impact to the aquatic habitat and aquatic life from the existing ferricrete in Railroad Creek. It is not necessary to eliminate hazardous substance releases if a reduction will be protective of human health and the environment (and meet ARARs). By contrast, reduction, as opposed to elimination, of this particular release of hazardous substances does not protect the aquatic environment since ferricrete will continue to form (although perhaps at a slower rate) so long as the release (e.g., iron and aluminum sulfates) continues.

Unique comment(s) addressed:
HVWC02-01, HVWC02-01a, HVWC02-01b, TGAR01-54f, INTA01-58

Comment and Response: 10-13

Comment:
RAO #2 includes monitoring sediment quality, which is standard practice at all cleanup sites and is therefore not a suitable objective of the remedial action.

Response:
The RI/FS shows that there have been adverse impacts to sediments in Railroad Creek and Lake Chelan, but that these impacts may not require active cleanup measures beyond source controls including elimination of ferricrete. (Forest Service 2007a). The RI/FS suggests that source control combined with natural geomorphic processes will result in elimination of adverse impacts to sediments, once ferricrete, iron floc, and suspended solids from erosion of the tailings piles are eliminated in Railroad Creek. In time, the elimination of the release of hazardous substances will eliminate potential impacts to sediments in Railroad Creek and Lake Chelan. However, implementation of the Selected Remedy includes effectiveness monitoring to confirm that risks are low and decrease over time following implementation of source controls.

The Selected Remedy includes creek relocation and source controls that the Agencies believe will be protective of receptors in Railroad Creek sediments. The RAO includes sediment quality monitoring to assure that other more protective remedy components would be implemented in a timely manner if needed. It is appropriate that the ROD identify specific monitoring requirements to ensure that the remedy is protective.. This is particularly important since conditions at the Site exceed reasonable sediment quality guidance (TBC), and prior surveys indicate significant adverse impacts to benthic macroinvertebrates (see Ecology 1997, Stratus 2005).

Unique comment(s) addressed:
HVWC02-01c

Comment and Response: 10-14

Comment:
RAO #3 inappropriately identifies a remediation tool (using methods to prevent migration) as a remediation goal; the goal should be to protect human health and the environment.

Response:
Although restoration of groundwater throughout sites is the goal of both CERCLA and MTCA, with active management of the contaminated groundwater within a WMA, MCLs may be met at and

beyond the edge of the WMA instead. Preventing the spread of contaminated groundwater is a reasonable as a generic RAO for the Site to protect aquatic life and comply with ARARs. The development and analysis of alternatives appropriately considered the methods to accomplish this RAO.

Unique comment(s) addressed:
HVWC02-02

Comment and Response: 10-15

Comment:
ARARs compliance is measured at points of compliance (POCs) which are not necessarily at waste management area (WMA) boundaries. Human health protection can be assured as long as groundwater outside the WMA meets drinking water standards or some form of institutional control is in place.

Response:
The Proposed Plan and supporting documentation (ASFS, Forest Service 2010a) as well as the ROD, specifically acknowledge that groundwater within the WMAs will not comply with ARARs within any reasonable restoration time frame, based on information provided in the FS. Groundwater at the Site must be restored to drinking water standards, see 42 U.S.C. § 9621(d)(2)(A). (MTCA also identifies the highest beneficial use of groundwater on the Site is as a source of drinking water).

It is the containment or management of the contaminated groundwater within the WMA that enables the point of compliance to be at the edge and beyond the WMA, rather than throughout the plume, (unless there is an ARAR waiver based on technical impracticability). The MCLs are relevant and appropriate requirements for groundwater at this Site, 42 U.S.C. § 9621(d)(2)(A). At and beyond the WMA boundaries, groundwater must achieve cleanup levels (55 Fed. Reg. 8753, and 53 Fed. Reg. 51426). As a general matter, a remedy should not use institutional controls as the primary remedy when more active and more reliable measures are practicable. While before the groundwater-surface water interface is the POC for protection of surface water, the POC for the selected remedy for achieving MCLs is at and beyond the edge of the WMA.

Unique comment(s) addressed:
HVWC02-02a

Comment and Response: 10-16

Comment:
RAO #3 is inappropriate because it, in effect, specifies containment that limits the range of alternatives. The objective in RAO #3 to prevent migration of hazardous substances outside WMAs is not appropriate as a goal in itself because such prevention should not be required if not necessary to protect aquatic life or meet ARARs.

Response:
The third RAO is to prevent migration of contaminants of concern that exceed cleanup levels in groundwater (including the Main Portal discharge) from on-site waste management areas (WMAs), to protect aquatic life and comply with ARARs.

RAO # 3 does not specify containment; however, the final Feasibility Study indicated that containment with a barrier wall is the best method to prevent migration of contaminants. Groundwater contamination in the Lower West Area and under the tailings piles exceeds MCLs. In accordance with CERCLA Section 121(d)(2)(A) [42 U.S.C. § 9621(d)(2)(A)], and the NCP, groundwater at the Site must be restored to meet MCLs – MCLs are relevant and appropriate requirements at this Site. The NCP provides that groundwater will be returned to its beneficial uses (including MCLs) within a reasonable restoration time frame wherever practicable [40 C.F.R. § 300.430(a)(1)(iii)(F)]. Although the point of compliance for groundwater cleanup under CERCLA is generally throughout the contaminated plume, the NCP recognizes that remedies may involve areas where waste materials will be managed in place. These areas are WMAs.

Certain groundwater source areas at the Site, including the Lower West Area and the tailings piles, if contained, can be considered WMAs. This is because modeling described in Section 3.1 of the SFS indicates exceedances of cleanup levels in the Lower West Area are expected to continue for hundreds of years. Available information also indicates that it will be hundreds of years before groundwater below the tailings and waste rock piles achieves cleanup levels (see Appendix E of the DFFS, URS 2004). Also, during the development of alternatives, relocation of the tailings piles was identified as not practicable. Because no alternative was identified that could clean up groundwater beneath the tailings piles and waste rock piles, the tailings piles and waste rock piles will continue to serve as a source of contamination to groundwater [see Section 3.1 of the SFS (Forest Service 2007) for a discussion of why source depletion is not an acceptable alternative]. When restoration of groundwater is not practicable, it is necessary to prevent further migration of the plume and to prevent exposure to the contaminated groundwater [40 C.F.R. § 300.430(a)(1)(iii)(F)]. Thus, groundwater containment is a necessary aspect of a WMA so that contaminants do not migrate.

The Agencies identified on-site WMAs to address non-attainment of groundwater cleanup within the WMAs, see Section 2.5 of the ASFS (Forest Service 2010a). Without containment, MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3 unless an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 is justified based on technical impracticability from an engineering perspective. So long as groundwater is managed, the point at which groundwater must achieve cleanup levels is at and beyond the edge of the WMA (55 Fed. Reg. 8753, and 53 Fed. Reg. 51426).

It is appropriate for the RAO to refer to WMAs since it is necessary to achieve ARARs (i.e., MCLs) in groundwater at the edge of the WMA to satisfy the requirements of CERCLA.

The Selected Remedy involves construction of the groundwater barrier in two phases to reduce the impact of construction on Holden Village. Intalco has not demonstrated that the first phase of barrier construction, limited groundwater collection and treatment, capping, and on-site run-on controls will sufficiently reduce or allow attenuation of groundwater contamination below the tailings and waste rock piles. However, after completion of the first stage of remedial construction and operation, if Intalco can conclusively demonstrate that a second phase groundwater barrier is not needed or that the containment approach represented by the second phase barrier wall could be modified to meet cleanup levels effectively, then the Agencies could alter the remedy through a ROD Amendment.

Unique comment(s) addressed:
TGAR01-54G, INTA01-59

Comment and Response: 10-18

Comment:
The fifth RAO is inappropriate because it assumes concentrations of contaminants in soil and groundwater present a risk to humans; Intalco believes the Agencies have overstated the risks posed by soil and groundwater.

Response:
The fifth RAO is "Protect human health and comply with ARARs by reducing human exposure to hazardous substances in soil and other wastes, and in groundwater as a drinking water resource."

The Agencies have not overstated the risk to humans at the Site. Section 4.1 and Tables 2 and 3 of the Proposed Plan identify areas of the Site where there are risks to Human Health from: a) direct contact and/or ingestion of soil (i.e., the Honeymoon Heights Waste Rock Piles and areas immediately downslope, the Lower West Area, the Lagoon, and the Maintenance Yard); b) where soils have concentrations of hazardous substances that exceed groundwater protection criteria (i.e., the tailings piles, waste rock piles, Honeymoon Heights Waste Rock Piles, Maintenance Yard, and the SRA); and c) areas where groundwater exceeds drinking water standards (i.e., seeps associated with the Honeymoon Heights Waste Rock Piles, the mine portal drainage, the Lower West Area, East and West Waste Rock Piles, and the three tailings piles). Groundwater on the Site is a future potential source of drinking water and must meet the cleanup criteria unless contained within a WMA.

Unique comment(s) addressed:
TARG01-54i

Comment and Response: 10-19

Comment:
The sixth RAO includes a regulatory component and should be revised.

Response:
The sixth RAO is "Implement the remedial action in a manner that complies with ARARs and protects human health, welfare, and the environment, including the Holden Village residential community during and after construction."

The inclusion of meeting ARARs in the sixth RAO does not limit approaches that could be taken to alternative development and addressing RAOs. Alternatives presented in the Proposed Plan are evaluated as to whether they meet the nine criteria under CERCLA [40 C.F.R. § 300.430(e)(9)(iii)(B)], of which, compliance with ARARs is a threshold criterion. The evaluation of compliance with ARARs is presented in Sections 6.2 and 6.4 of the ASFS, in Section 9.1.1.2 in the Proposed Plan, and in Section 10.1.1 of the ROD.

Unique comment(s) addressed:
TARG01-54j

Comment and Response: 10-20, 10-131

Comment:

Original RAOs were developed consistent with ARARs and discussed with Intalco in 1999, agreed upon, and used throughout the RI/FS process. In 2007, the Agencies unilaterally abandoned the properly developed RAOs and inappropriately selected new arbitrary RAOs in an after-the-fact effort to justify selection of the Agencies then-proposed plan.

The Proposed Plan relies on a moving target of inappropriate RAOs that are inconsistent with NCP. The Agencies have tailored their RAOs to justify selection of a remedy that is less reliable and more expensive than the Alternatives Intalco developed under the agreed RAOs.

Response:

The so-called "moving target" appears to be the modification of the RAOs from the draft RAOs developed in 1999 to those which were then used during the draft and final Feasibility Study processes, and ultimately presented in the Proposed Plan. The Agencies note that their February 26, 1999, letter to Alumet (subsequently Intalco) specifically noted that Agencies did not consider the draft RAOs presented at that time to be complete, "and, therefore, may find it necessary to add additional RAOs later."

The NCP provides for the establishment of Remedial Action Objectives (RAOs) that specify "contaminants and media of concern, potential exposure pathways and remediation goals," [40 C.F.R. § 300.430(e)(2)(i)]. The remediation goals are initially based on readily available information, such as chemical-specific ARARs, and are to be modified as more information becomes available; final remedial goals are determined in the ROD.

The Agencies disagree with the comment writer's characterization that RAOs were agreed upon in 1999 and subsequently used throughout the RI/FS process. None of the alternatives that Intalco identified and analyzed in the DFFS addressed all the sources of hazardous substances at the Site, and none of these alternatives met the threshold requirements for selection of a permanent remedy. The Agencies restated the RAOs based on better understanding of conditions at the Site as new information was developed during the RI/FS process. Development of additional information continued through completion of the final Feasibility Study, leading to the RAOs that were presented in the Proposed Plan, and ultimately in the ROD.

Unique comment(s) addressed:

TARG01-13, TARG01-54, TARG01-54k, TARG01-54l, TGAR01-54a, TGAR01-54b

Comment and Response: 10-21

Comment:

The Agencies' most recent proposed RAOs are significantly flawed because they are too action-specific. EPA guidance provides RAOs should not be so specific that they limit the range of alternatives that can be developed.

Response:
The RAOs presented in the Proposed Plan do not limit the range of alternatives that can be developed and evaluated. The RAOs specifically address the media of concern, potential exposure pathways, and remediation goals for hazardous substances.

Unique comment(s) addressed:
TARG01-54c, TARG01-54d

Comment and Response: 10-22

Comment:
Decisions should not be governed by inappropriate regulatory provisions. The state's limited-purpose landfill regulations are not ARARs.

Response:
Threshold criteria for selection of a remedial action include compliance with ARARs. The intent is for decisions regarding remedial actions to be governed by regulations. The state's limited purpose landfill regulations (WAC 173-350-400) are relevant and appropriate for the circumstances of the remedial action contemplated, as required in 40 C.F.R. § 300.400(g)(2).

The tailings and waste rock piles are currently releasing hazardous substances above state and federal cleanup levels. The selected remedial action includes capping to protect human health and the environment. Since the limited purpose landfill regulations address a similar situation these regulations are relevant and appropriate for the remedial action.

Unique comment(s) addressed:
TARG01-42, INTA01-37

Comment and Response: 10-23

Comment:
Alternative 14 cap requirements are ambiguous.

Response:
The final Feasibility Study specifies performance requirements for capping the tailings and waste rock piles, which are derived from ARARs (see Appendix C of the ASFS, Forest Service 2010a). Alternative 14 provided for cap design to satisfy these performance requirements following completion of the ROD, and this has been incorporated into the Selected Remedy. Thus, the requirements for the remedial action are based in regulations determined to be applicable or relevant and appropriate in accordance with the CERCLA threshold criteria.

Unique comment(s) addressed:
TGAR01-42a

Comment and Response: 10-24

Comment:
Appendix C (titled Performance Requirements for Capping Hazardous Substances) should be removed from the ASFS and not used for remedy selection or design. This appendix misidentifies

"potentially relevant and appropriate" requirements, uses them to derive performance requirements not in the regulations themselves, and misapplies the regulations cited.

Response:
The Agencies selected ARARs for the Site in accordance with 40 C.F.R. § 300.400(g). The performance requirements for capping hazardous substances at the Site are based on ARARs, and, therefore, a remedial alternative must satisfy these requirements to meet the threshold criteria for selection of a permanent remedy under CERCLA and MTCA, unless the ARAR is waived. All requirements being applied are present in the ARARs.

Unique comment(s) addressed:
INTA01-38

Comment and Response: 10-100, 10-104, 10-166 and 10-167

Comment:
The Limited Purpose Landfill (LPL) regulations should not be considered relevant and appropriate because their purpose relates to operating facilities; Holden is a facility that has been closed for over 50 years. The state LPL regulations are not ARARs.

Washington State Solid Waste Handling Standards (RCW 70.95 and WAC 173-350) is only applicable to the proposed limited purpose landfills at the Site that will be used for disposal of waste generated during remediation. (Consolidation of excavated tailings and soils from other parts of the Site onto the existing tailings piles does not constitute disposal in a landfill since under CERCLA, movement of soils and materials within an area of contamination does not constitute disposal, as described in Section 3.3.14 of the DFFS.)

A site-specific determination should be made to determine what is needed (and where) to protect human health and the environment, rather than applying LPL regulations.

Response:
Although mine operations that involved construction of the tailings and waste rock piles did cease before the effective date of the LPL regulations (Chapter 173-350 WAC), the closure standards of the LPL regulations are relevant and appropriate since these waste piles contain the types of materials that the LPL regulations are intended to address [see WAC 173-350-100]. The LPL regulations address problems or situations sufficiently similar to those encountered at the Site that their use is well suited to the Site. The LPL regulations would be applicable, rather than relevant and appropriate, for the disposal of new wastes generated as part of this action (e.g., for future disposal of sludge.

The site-specific risk assessment completed during the RI/FS identified that the tailings and waste rock piles are currently releasing hazardous substances above state and federal cleanup levels and the Selected Remedy includes capping to protect human health and the environment. Since the limited purpose landfill regulations address a similar situation, these regulations are relevant and appropriate for the Selected Remedy.

The LPL performance standards provide a sound basis for a site-specific determination of what is needed for capping the tailings and waste rock piles.

Unique comment(s) addressed:
HVWC02-09, HVWC02-9a, INTA01-37, TGAR01-10a, TGAR03-28, TGAR03-29

Comment and Response: 10-102 and 10-103

Comment:
The language in the Proposed Plan is confusing (p. 29) where it says State Freshwater Sediment Quality Values (FSQV) are potentially relevant and appropriate.

The Corps of Engineers sediment evaluation framework is not relevant or appropriate, and was never intended for use as cleanup standards.

The Proposed Plan could reference Ecology rule-making process and say sediment standards promulgated after the ROD will be considered during monitoring following remedy implementation.

Response:
Since prior surveys indicate significant adverse impacts to benthic macroinvertebrates in Railroad Creek (Ecology 1997, Stratus 2005) it is necessary to further assess sediment quality through both chemical analysis and bioassays to verify that the Selected Remedy (source controls and relocation of Railroad Creek in the area of ferricrete deposition) is effective. At this Site, the Agencies have determined that the information provided in the Sediment Evaluation Framework for the Pacific Northwest screening levels (SEF) (US Army Corps of Engineers et al. 2006), FSQVs, and scientific literature as discussed in the SFS are relevant and appropriate for initial screening to evaluate and compile the ROD list of contaminants of concern. The SEF consolidates the existing regional sediment testing guidance manuals and is commonly used throughout the Pacific Northwest for both freshwater and marine sediment assessment. FSQVs were developed (but not promulgated) for the State of Washington for freshwater sediment and are also commonly used.

Neither the federal government nor Washington State has established freshwater sediment concentration-based standards. The Agencies anticipate that freshwater sediment criteria will continue to evolve. The State of Washington has adopted Sediment Management Standards (SMSs) as Chapter 173-204 WAC. Although the SMSs numerical and biological standards have not been finalized for freshwater sediment, sediment narrative standards are adopted and guidance documents are available that apply to freshwater sediment. Currently, Ecology's freshwater sediment standards are evaluated on a case-specific basis (WAC 173-204-340) using specific professional judgment and latest scientific knowledge (WAC 173-204-110(6)).

Ecology has been working on revising the SMS to include much more detailed freshwater sediment regulations (narrative, numerical, and biological); however, these are not adopted yet. Sediment standards adopted after the ROD will be considered during monitoring following remedy implementation. In addition, the ROD requires chemical and bioassay sediment monitoring and outlines current bioassay evaluation criteria used by the state.

Unique comment(s) addressed:
HVWC02-8a, HVWC02-8b, HVWC02-8c

Comment and Response: 10-105

Comment:
App. C (Performance Objectives for Capping Hazardous Substances) should be removed from the ASFS and not used for remedy selection or design. This appendix misidentifies "potentially relevant and appropriate" requirements, uses them to derive performance requirements not in the regulations themselves, and misapplies the regulations cited.

Response:
Appendix C of the ASFS develops performance requirements for caps that may be used to address certain areas of contaminated soils. Such caps have been proposed in Alternatives 11M, 13M, and 14 for the Maintenance Yard. The performance requirements were developed to be protective of human health and the environment and were drawn from concepts embodied in several ARARs, as follows:

WAC 173-340-7490 through 173-340-7494 define the procedures for conducting a Terrestrial Ecological Evaluation (TEE) under MTCA. WAC 173- 340-7491 outlines several conditions under which the performance of a TEE is not required because the conditions limit exposure and are considered to be adequately protective of terrestrial organisms. The Agencies consider conditions defined in WAC 173-340-7491(1) to be relevant and appropriate for developing criteria for caps over hazardous substances. The Agencies also consider requirements in WAC 173-350-400 that address the long-term protectiveness, durability, and maintenance of landfill caps to be relevant and appropriate performance criteria for caps on hazardous substances that are not landfills. In addition, aspects of the Pacific Northwest Forest Plan Section MM-3 (MM-3) that are relevant and appropriate to closure of the tailings and waste rock piles at the Site are also relevant and appropriate for developing criteria for caps over hazardous substances.

The criteria developed in Appendix C were provided for the purpose of remedial design, and were not used to differentiate one alternative from another.

Unique comment(s) addressed:
INTA01-38

Comment and Response: 10-106

Comment:
The objective in RAO #4 to "reduce" exposure to hazardous substances in soils should be replaced by the neutral term "protect terrestrial organisms."

Response:
RAO #4 is presented in the ROD as follows:

> "Reduce exposure to contaminants of concern in soil (including tailings and other wastes) to protect terrestrial organisms and comply with ARARs. Prevent future releases of tailings and other wastes into surface water to protect aquatic receptors from contaminants of concern."

Where exposure to hazardous substances results in unacceptable risk to terrestrial organisms, reducing exposure to hazardous substances is an appropriate component of a remedy.

Unique comment(s) addressed:
INTA01-60

<u>Comment and Response: 10-107 and 10-154</u>

Comment:
The Agencies have not taken care to identify ARARs with meaningful specificity. For example, the Agencies identify all of MTCA as ARAR. The Agencies cannot designate all of a statute and its regulations as ARAR, but must identify each "standard, requirement, criteria, or limitation," that is ARAR, as required by CERCLA 121(d)(2)(A)(ii).

Response:
The Agencies have identified ARARs in the ROD and previously in the final Feasibility Study, and provided tables that show specific requirements for hazardous substances that are left on Site. The Agencies believe the level of detail provided is appropriate to satisfy the requirements of Section 121(d)(2)(A)(ii) of CERCLA, 42 U.S.C. § 9621(d)(2)(A)(ii).

Unique comment(s) addressed:
INTA01-61, TGAR03-16

<u>Comment and Response: 10-108</u>

Comment:
The LPL presumptive cover with liner is inappropriate.

The LPL regulations are too prescriptive. Intalco requests Agencies make decisions on tailings and waste rock cover on a technical basis rather than provisions of the LPL regulations that are not relevant or appropriate. The cover components for the tailings and waste rock piles are not relevant and appropriate.

Response:
The Selected Remedy includes capping the tailings and waste rock piles to conform with ARARs, including the LPL regulations (which are relevant and appropriate) but does not require that the caps satisfy the presumptive requirements [WAC 173-350-400(3)(b)(v)] or more specifically include a geomembrane liner. The LPL regulations allow for alternative cap designs that meet the performance standards (WAC 173-350-400).

The Agencies disagree that the LPL regulation are overly prescriptive, and the ROD specifically notes that the tailings and waste rock pile caps will be designed to satisfy performance requirements and not the presumptive requirements of the LPL regulation. The relevant and appropriate performance requirements include the following: a) prevent exposure of waste; b) minimize infiltration; c) prevent erosion from wind and water; d) be capable of sustaining native vegetation; e) provide sufficient stability; f) provide for the management of run-on and runoff to preventing erosion or other damage to the cap; and g) minimize the need for post-closure maintenance.

Unique comment(s) addressed:
TGAR01-10b, TGAR01-43, TGAR01-43a, TGAR01-45

<u>Comment and Response: 10-109</u>

Comment:
Reliance on the LPL regulations is inconsistent with the NCP. 40 C.F.R. § 520(h)(2) (sic) requires ARARs be identified in scoping the RI/FS and prior to detailed analysis of FS alternatives.

Response:
The commenter may have intended to refer to 40 C.F.R. § 300.515(h)(2). The last sentence of 40 C.F.R. § 300.515(h)(2) is "The lead agency shall thereafter consult with the support agency to ensure that identified ARARs and TBCs are updated as appropriate." ARARs include <u>any</u> standard, requirement, criteria, or limitation under federal environmental law, or any promulgated standard, requirement, criteria, or limitation under a state environmental or facility siting law that is more stringent than any federal standard, see 40 C.F.R. § 300.5. To properly evaluate alternatives the RI/FS identified potential ARARs that would or might apply to the circumstances at the Site and the remedy components under consideration.

Potential ARARs were identified and updated as the RI/FS proceeded as described below.

The identification of ARARs and, as appropriate, other criteria, advisories, or guidance to be considered (TBCs) started early in the RI/FS process, see for example Dames and Moore (1999) and Forest Service (2000). As the RI/FS progressed, additional ARARs were identified based on the types of chemicals, locations, and remedial activities that they addressed. Potential ARARs and their relevance to different remedial alternatives were evaluated in the following documents:

- The draft FS (URS 2002) and comments by the Agencies (Forest Service 2002) and related correspondence (Forest Service 2003);
- The DFFS (URS 2004) and the Agency comments on the DFFS (Forest Service 2007a);
- The SFS (Forest Service 2007b);
- Alternative 9 (Covington and Burling 2005, and Forest Service 2007c);
- Alternative 13 (Covington and Burling, 2007, ERM and URS 2009, and Forest Service 2010a);
- The ASFS (Forest Service 2010b); and
- Other correspondence between the Agencies and Intalco.

Compliance with ARARs was an integral consideration in the remedy selection process.

The outcome of the ARAR identification process is documented in Section 13.2 and Tables 16 through 19 of the ROD, which presents the ARARs and the TBCs that are applicable or relevant and appropriate for the Selected Remedy. The scope and relevance of these ARARs and TBCs for the Holden Site is also discussed in Section 6.2 of the Proposed Plan and Appendix D of the Addendum to the Supplemental Feasibility Study. Additional details on how the Selected Alternative will meet ARAR requirements will be developed during Remedial Design.

Unique comment(s) addressed:
TGAR01-44

Comment and Response: 10-110 and 10-115

Comment:
The LPL cover design standards are not relevant and appropriate at CERCLA sites, because the water quality concerns underlying the LPL requirements are addressed by other components of the CERCLA cleanup action.

If any portion of the LPL requirements is relevant, it is only the post-closure provisions. Design and location components of the LPL regulations are not relevant because the tailings and waste rock piles are already constructed.

Response:
The tailings and waste rock piles are currently releasing hazardous substances above state and federal cleanup levels. The Selected Remedy includes capping these waste piles to protect human health and the environment. Since the limited purpose landfill regulations address a similar situation, these regulations are relevant and appropriate for the remedial action. The ROD does not require that the Selected Remedy conform to all design standards presented in the LPL, (e.g., the ROD does not require the cap include provisions for control of methane and other explosive gases since these are not concerns for the tailings and waste rock piles), rather it refers to such aspects as the performance requirements for cap design, which are relevant and appropriate.

The Agencies concur that portions of the post-closure provisions of the LPL are also relevant and appropriate.

Unique comment(s) addressed:
TGAR01-45a, TGAR01-48b

Comment and Response: 10-111

Comment:
Application of the LPL fails to meet the reasonableness test under AKART. The common remedy of all alternatives under consideration will address infiltration of storm water - the Agencies concern about runoff is misplaced.

Response:
The LPL performance requirements for caps specifically refer to design that minimizes surface water run-on and runoff (i.e., stormwater) to prevent erosion or other damage of the cap. Another of the performance criteria, reduction of infiltration, is intended to reduce the amount of leachate generated, that would otherwise need to be collected and treated. These are reasonable design objectives.

Unique comment(s) addressed:
TGAR01-45b

Comment and Response: 10-112

Comment:

Construction of a soil cover is not needed to promote revegetation of the tailings. There is no need to consider revegetation of the waste rock piles because similar natural rock formations do not support vegetation.

Response:

Tailings and waste rock are not naturally occurring substances as defined in 42 U.S.C. § 9604(a)(3)(A). Revegetation of tailings and waste rock piles is needed to satisfy the requirements of WAC 173-35-400(3)(e)(i)(D), and as a practical matter to prevent erosion [WAC 173-35-400(3)(e)(i)(C)], and to satisfy restoration requirements in the Forest Plan (NWFP Standards and Guidelines MM-3d). To re-establish vegetation, suitable soil is necessary to support growth.

Waste rock and tailings piles are not comparable to natural rock formations (e.g., surface area, exposure to water and air increasing metals and sulfate solubility, fate and transport, etc.). Rather, they are wastes left from mine development. The waste rock piles and tailings piles are releasing hazardous substances to the environment, and need to be remediated in accordance with both state and federal law. Currently, these wastes present a direct exposure pathway to plant, macroinvertebrate, and wildlife communities; and exceed cleanup standards. The risk from exposure of hazardous substances to specific organisms collected from these areas was determined to be significant in the final Feasibility Study. The remedy requires that a soil cap be constructed over the waste rock and tailings piles to reduce exposure to terrestrial organisms.

Unique comment(s) addressed:

TGAR01-45c

Comment and Response: 10-113

Comment:

The State of WA and EPA do not consistently apply the LPL. Although the LPL regulations are sometimes cited, a 2-foot cover with geomembrane liner is not consistently cited, e.g., Beth Lake, Longshot Mine, and Oriole Mine.

An alternative cover is allowed when the nature of the waste, disposal site, or other factors are incompatible with the final closure cover system.

Response:

The Selected Remedy at Holden does not include a cap with a geomembrane liner.

The Selected Remedy will need to satisfy the LPL performance requirements for caps that are relevant and appropriate to protection of human health and the environment.

The sites noted in the comment (Beth Lake and Oriole Mine) are removal actions implemented by the Forest Service (a removal action decision for Longshot is pending and had not been issued at the time of the comment). The issue of consistent application of requirements under CERCLA pertains to whether the state consistently applies its own requirements, see 42 U.S.C. § 9621(d)(4)(E). Since these examples are CERCLA actions undertaken by the Forest Service, they do not support the commenter's point. The cited examples do not demonstrate that the State of Washington has inconsistently applied LPL standards. Ecology has in fact invoked the LPL standards consistently. Recently, for example, Ecology invoked LPL closure standards as relevant and appropriate requirements for the cleanup action at the Pend Oreille Mine Tailings Disposal Facilities Nos. 1 & 2 Site (effective under the Consent Decree in *State of Washington, Department of Ecology v. Teck Washington Incorporated*, Pend Oreille Superior Court No. 11-2-0083-1, entered April 25, 2011). Cleanup components are not always the same at every site, as dictated by site-specific conditions.

Unique comment(s) addressed:
TGAR01-46, TGAR01-47b

Comment and Response: 10-114

Comment:
The Agencies are obliged by the NCP to consider any variances available in making an ARAR determination.

Setback of the tailings piles from Railroad and Copper Creeks is unneeded to address stability, is not warranted to protect the environment, and would be a hardship. All of Intalco's proposed alternatives address stability and erosion concerns without the need for a setback.

The Agencies have contended the tailings piles must be set back from Railroad and Copper Creeks to meet requirements of the LPL regulations. Although relocation of Railroad Creek may render the issue moot, Intalco should have the flexibility during Remedial Design to show that a setback of less than 45 feet is protective, including with respect to Copper Creek. The setback requirement fails to meet NCP criteria at 40 C.F.R. § 300.400(g)(2).

Response:
The NCP sets forth the criteria for determining whether a potential requirement is relevant and appropriate, including variances, waivers, and exemptions [40 C.F.R. § 300.400(g)(2)(v)]. The Agencies concluded that the LPL are relevant and appropriate. The Agencies will certainly consider variance provisions in determining whether the Selected Remedy will satisfy a particular potentially relevant and appropriate requirement.

The commenter is mistaken in believing that the Agencies contend that the tailings piles must be set back from Railroad and Copper Creeks to meet requirements of the LPL regulations. The Selected Remedy includes a combination of creek relocation and setback of the toe of the tailings piles to enable construction of the groundwater barrier and collection system; provide long-term protection against channel migration, stream bank erosion and scour from causing instability of the tailings; and to provide access for maintenance and monitoring, all of which are needed to comply with ARARs.

Although Intalco has suggested that setback of the tailings piles from Railroad and Copper Creeks (or alternatively to relocate portions of the creeks) is not required to assure stability, to date Intalco has not demonstrated how this would be accomplished. During preparation of the final Feasibility Study, Intalco presented extensive calculations that showed stabilization of the tailing piles would require construction of large earthen buttresses that, by its own analyses, would require either creek relocation, and/or pulling back the toe of the tailings pile slopes. Since Intalco has not shown how stability of the tailings piles would be accomplished without moving either the creeks or the tailings pile slopes, the Agencies disagree that Intalco's proposed alternatives address stability and erosion concerns without the need for a setback.

Unique comment(s) addressed:
TGAR01-47, TGAR01-47a, TGAR01-48, TGAR01-48a, TGAR01-48d.2

Comment and Response: 10-116

Comment:
Exposure of the tailings to humans and wildlife, stability, management of runoff, and access for post-closure maintenance can be addressed without regard to the tailings proximity to the creek.

Response:
The Agencies disagree; proximity of the tailings piles to the creek is an important factor in long-term planning to address channel migration, potential stream bank erosion and scour, as well as access for slope regrading, capping, buttress construction, and possibly ground improvement (construction measures to increase the density and/or shear strength of the subgrade *in situ*, as suggested by Intalco), and post-construction maintenance and monitoring. These are all (or in the case of ground improvement, may be) necessary parts of the cleanup.

The Selected Remedy includes a combination of creek relocation and setback of the toe of the tailings piles to enable construction of the groundwater barrier and collection system; provide long-term protection against channel migration, stream bank erosion and scour from causing instability of the tailings; and to provide access for maintenance and monitoring, all of which are needed to comply with ARARs.

Unique comment(s) addressed:
TGAR01-48c

Comment and Response: 10-117 and 10-119

Comment:
The location components of WA LPL are not relevant and appropriate. The Agencies are mistaken that the LPL standards require more room for channel meandering.

Location components of the LPL regulations are appropriate only for placement of a new landfill, and do not take into account the impacts and risks of relocating an existing landfill. The Agencies have disregarded the NCP's requirement that the type of place regulated be considered in making ARAR decisions, see 40 C.F.R. §300.400(g)(2)(vi).

Response:
The comment is incorrect in its suggestion that the location components of the LPL regulations were relied on by the Agencies in determining the need to set back the toe of the tailings pile slopes from Railroad Creek.

The final Feasibility Study addresses the impacts and risks of relocating portions of the existing tailings piles and waste rock piles. For the most part, the Selected Remedy relies on relocating

Railroad Creek away from the tailings piles to provide room for construction and long-term maintenance, but notes that relocating portions of the tailings (e.g., adjacent to Copper Creek) may be necessary for construction or to assure long-term stability of the tailings piles. This will be further addressed during Remedial Design, as discussed in the ROD.

The Selected Remedy includes a combination of creek relocation and setback of the toe of the tailings piles to enable construction of the groundwater barrier and collection system; provide long-term protection against channel migration, stream bank erosion and scour from causing instability of the tailings; and to provide access for maintenance and monitoring, all of which are needed to comply with ARARs.

Unique comment(s) addressed:
TGAR01-48d.1, TGAR01-48e, TGAR01-48g

<u>Comment and Response: 10-118</u>

Comment:
The Agencies have disregarded the NCP's requirement that the size of the facility being regulated be considered in making ARAR decisions. RCW 70.95.060 makes it clear the state standards adopted for landfill facilities pertain to those that will exceed 100 acres.

Response:
The Agencies have considered the size and type of facility as required under 40 C.F.R. § 300.400(g)(2)(vii). The combined area and volume of tailings and waste rock piles that will be closed in accordance with the LPL regulations are substantial. The comment is incorrect in its suggestion that the size standards in RCW 70.95.060 limits the Agencies' selection of a remedy or in determining which potential ARARs are relevant and appropriate. RCW 70.95.060 does not limit the applicability of minimum functional standards to only landfills greater than 100 acres in area, but instead adds *additional* requirements to those standards for landfills of that size. The Agencies recognize the state landfill regulations are not entirely applicable, in part because of when the tailings and waste rock piles were established. Nonetheless, portions of these regulations are relevant and appropriate; e.g., the cap design and post-closure management standards of the LPL regulations.

Unique comment(s) addressed:
TGAR01-48f

<u>Comment and Response: 10-120</u>

Comment:
Groundwater monitoring requirements are not a reason to require setback of the tailings from Railroad Creek, but the Agencies claim LPL regulations require a setback of at least 100 feet from the property line to allow space for monitoring wells, runoff controls and other design elements.

The amount of setback may be increased to provide access to facility structures, which is either redundant or unwarranted. Even if a barrier wall were part of the remedy, a setback would only need to extend so far as necessary for installation.

Response:
The comment is mistaken in its suggestion that the Agencies believe a setback of 100 feet is necessary to comply with ARARs or for construction or maintenance purposes. The Selected Remedy includes a combination of creek relocation and setback of the toe of the tailings piles to enable construction of the groundwater barrier and collection system; provide long-term protection against channel migration, stream bank erosion and scour from causing instability of the tailings; and to provide access for maintenance and monitoring, all of which are needed to comply with ARARs. For cost estimating purposes only, the final Feasibility Study assumed a setback distance of 45 feet for Alternative 11M, but noted that the actual amount would need to be determined during Remedial Design. The final Feasibility Study assumed that Railroad Creek would be relocated away from the tailings piles for Alternative 14 (the basis for the Selected Remedy) but did not specify a minimum distance.

Unique comment(s) addressed:
TGAR01-48h, TGAR01-48k

Comment and Response: 10-121

Comment:
Agencies equate property lines with hydrologic boundaries.

Monitoring the groundwater-surface water interface would not require a setback of the tailings piles from the creeks, since MTCA is clear that monitoring occurs within the surface water.

Response:
The Agencies do not equate property lines with hydrologic boundaries. The exact locations and methods for monitoring the groundwater cleanup to protect surface water will be determined during Remedial Design and implementation of the remedy. However, at the Holden Mine Site, groundwater discharging to surface water must meet surface water cleanup standards before the groundwater-surface water interface to protect surface water beneficial uses in accordance with CERCLA and to comply with a MTCA groundwater conditional POC as close as practicable to the source under WAC 173-340-720(8)(c). This will include the use of groundwater monitoring wells to establish compliance. Under both CERCLA and MTCA, the remedy must be protective of all receptors, including benthic macroinvertebrates.

Unique comment(s) addressed:
TGAR01-48i, TGAR01-48j

Comment and Response: 10-122

Comment:
The aquatic conservation strategy (ACS) objectives of the Forest Plan are not a basis for requiring a setback of the tailings piles from the creeks. This strategy document is not a promulgated regulation and thus is not a potential ARAR.

The remedy will directly address water quality issues and will meet ACS objectives whether or not the remedy includes a setback.

Response:
Forest Plan provisions are ARARs. Forest Plans are promulgated since Forest Plans are subject to public notice and comment before a decision is made. 16 U.S.C. § 1604(d), 36 C.F.R. § 219.9. The Site has impacted riparian reserve areas, and compliance with the ACS objectives are relevant and appropriate requirements, but the comment is mistaken in indicating that this would require a setback of the tailings from Railroad and Copper Creeks.

Unique comment(s) addressed:
TGAR01-49a, TGAR01-49b

Comment and Response: 10-123

Comment:
Executive Orders 11988 and 11990 are not a basis for requiring the tailings to be set back from Railroad Creek. The Orders are implemented through NEPA Regulations, 40 C.F.R. Part 6, but the Justice Department has determined as a matter of law that NEPA does not apply to CERCLA cleanups.

The Executive Orders have not been interpreted by EPA to address remedial actions required of a private party, only to activities of federal agencies.

The protections called for in the Executive Orders are very general and Intalco's alternatives are fully consistent with action to minimize potential harm - no basis to prefer Alternate 14.

Response:
The Agencies have not said that any ARAR (including the referenced Executive Orders) requires moving the toe of the tailings piles away from Railroad Creek. The intent of moving the tailings (or alternatively moving the creek) is to provide room for construction of a groundwater collection trench and barrier wall, to provide access for maintenance of the tailings slopes and riprap along the creeks, and to provide access for monitoring. Moving Railroad Creek away from the tailings piles would also have the benefit of eliminating ferricrete from the aquatic environment.

Executive Order 11988 requires federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains; whereas Executive Order 11990 requires federal agencies to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. The orders are applicable to certain specified actions taken by federal agencies including for example, managing federal lands and facilities; and conducting federal activities that affect water and related land resources. Therefore, the orders are applicable to remedial activities that take place within the 100-year floodplain of Railroad and Copper Creeks and Site wetlands under CERCLA authority.

Unique comment(s) addressed:
TGAR01-50a, TGAR01-50b, TGAR01-50c

Comment and Response: 10-124 and 10-160

Comment:
Intalco submits that the Standards and Guidelines, that are part of the Forest Service's 1990 Land and Resource Management Plan (LRMP) for Wenatchee National Forest and the 1994 Pacific Northwest Forest Plan (NWFP, including subsequent amendments), are not an ARAR, but at most the Roads Management components are TBC factors for the remedy.

The Land and Resource Management Plan (LRMP) for the Wenatchee National Forest is a TBC, not an ARAR. (It is not a promulgated requirement, but serves as guidance in managing forest lands.)

Response:
The National Forest Management Act (NFMA) is the primary statute governing the administration of National Forests. The USDA Forest Service promulgated the LRMP as required by the NFMA. The standards and guidelines within the LRMP apply to lands administered by the USDA Forest Service. Actions on the National Forest must meet the LRMP standards and guidelines, including, for example, protection for riparian areas and waters. Remediation will alter portions of the Site including Riparian Management Areas along Railroad and Copper Creeks. Consequently, specified standards and guidelines are applicable or relevant and appropriate for the Site.

Unique comment(s) addressed:
TGAR01-52a, TGAR03-22

Comment and Response: 10-125, 10-126 and 10-127

Comment:
The Standards and Guidelines set forth in MM-1 through MM-6 are not an ARAR because they are designed to inform conduct during minerals operations, they are expressly prospective, whereas a CERCLA cleanup is retroactive.

MM-3(b) refers to techniques for design of new waste facilities and not the conduct of actions to address existing tailings piles.

MM-3(d) refers to reclaiming waste facilities, unlike the present case, wherein reclamation would be feasible and appropriate in light of the waste facilities having been designed and located using the best conventional techniques in accordance with MM-3(b).

Response:
As a general rule, LRMP standards and guidelines for riparian reserves prohibit or regulate activities in riparian areas that retard or prevent attainment of the Aquatic Conservation Strategy objectives. MM-1 through MM-6 do address establishing protection of the riparian reserves prior to mining. However, these standards and guidelines are relevant and appropriate to activities that would delay or make it more difficult to attain the Aquatic Conservation Strategy objectives during and after implementation of the Selected Remedy.

Since MM-3(b) addresses location and design of new waste facilities, it is relevant and appropriate to ensure stability of the tailings piles that will be physically altered as part of the remedy, to prevent the future release of toxic materials.

MM-3(d) addresses reclaiming waste facilities after mining operations to ensure chemical and physical stability to meet Aquatic Conservation Strategy objectives. These requirements are relevant and appropriate to cleanup actions taken at the Site.

Unique comment(s) addressed:
TGAR01-52b, TGAR01-52c, TGAR01-52d

Comment and Response: 10-128

Comment:
None of the alternatives evaluated in the DFFS or SFS would remove tailings from the riparian reserve.

Response:
The comment is correct. The final Feasibility Study indicated that it is not practicable to remove the tailings piles from the Site.

Unique comment(s) addressed:
TGAR01-52e

Comment and Response: 10-129

Comment:
Even if the Forest Service Standards and Guidelines were an ARAR, they would not justify selection of Alternative 14 over Alternatives 13M or 9, because those alternatives would achieve the nine ACS objectives described on page B-11 of the standards and guidelines.

Response:
Comment noted. However, Alternatives 9 and 13M do not satisfy other ARARs. For example, as discussed in Section 4.2.1.2.5 of the SFS, Alternative 9 does not include closure and reclamation of the tailings and waste rock piles using best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials, and, therefore, would not comply with the standards and guidelines. Absent a valid waiver, the Selected Remedy must comply with all ARARs.

Unique comment(s) addressed:
TGAR01-52f

Comment and Response: 10-130

Comment:
The provisions of MM-3 are not an ARAR because they are directed at activities within riparian reserves. Intalco demonstrated that none of the waste rock piles are within riparian reserves.

Response:
The waste rock piles are not in the riparian reserves, however, substantial portions of the tailings piles are within riparian reserves.

Unique comment(s) addressed:
TGAR01-53

Comment and Response: 10-132

Comment:
The fourth RAO is inappropriate because it assumes the concentrations of contaminants in soils are not currently protective.

Response:
The fourth RAO is to reduce exposure to contaminants of concern in soil (including tailings and other wastes) to protect terrestrial organisms and comply with ARARs, and to prevent future releases of tailings and other wastes into surface water to protect aquatic receptors from contaminants of concern.

Information collected at the Site shows concentrations of hazardous substances at the Site pose an unacceptable level of risk and have negatively impacted terrestrial and aquatic receptors at the Site. Section 7.2.3 and Tables 11 of the ROD identify areas of the Site where soil concentrations result in hazard quotients for terrestrial receptors greater than 1, including: the tailings piles, waste rock piles, Ballfield Area, Holden Village, the area downslope of the Honeymoon Heights Waste Rock piles, the Lower West Area, Lagoon, SRA, and the Maintenance Yard. Soil at the Site, including the tailings and waste rock, are also an ongoing source of hazardous substances released to groundwater and surface water above concentrations that are protective of aquatic life.

Unique comment(s) addressed:
TGAR01-54h

Comment and Response: 10-133

Comment:
The Agencies' most recent proposed RAOs are significantly flawed because they are too action-specific.

Response:
The RAOs presented in the Proposed Plan and ROD do not limit the range of alternatives that can be developed and evaluated. The RAOs specifically address the media of concern, potential exposure pathways, and remediation goals for hazardous substances.

Unique comment(s) addressed:
TGAR01-54c

Comment and Response: 10-134 and 10-142

Comment:

The National Toxics Rule (NTR) Freshwater Aquatic Life Criteria have not been adopted by the state of Washington and are not applicable, or relevant and appropriate.

The NTR is not an ARAR for surface water or groundwater at the Site. (The Agencies indicate that the National Toxics Rule (NTR) established numeric water quality standards for protection of human health and aquatic organism for states that failed to fully comply with Section 303(c)(2) (C) of the CWA. The State of Washington is required to comply with certain standards in the NTR (40 C.F.R. § 131.36(d)(14)), and MTCA identifies the NTR as an ARAR (WAC 173-340-730(3)(b)(i)(C)). The NTR standards mandated for Washington are potentially applicable for the Site. The state of Washington has adopted by reference only the human-health based criteria as referenced in 40 C.F.R. § 131.36(d)(14) and (WAC 173-201A-240(5)). The freshwater aquatic life criteria have not been adopted by the state of Washington and are not potentially applicable or relevant and appropriate. Only the human- health based standards specified in 40 C.F.R. § 131.36(d)(14) are potentially applicable to surface water at the Site. These human-health based ARARs are potentially relevant and appropriate to hazardous substances in groundwater that are likely to reach surface water. No human-health standards have been established under the NTR for the contaminants of potential concern in surface water or groundwater; therefore, the NTR is not considered a potential ARAR for surface water or groundwater at the Site.)

Response:

CERCLA specifies in Section 121(d)(2)(A) that any standard, requirement, criteria, or limitation under any federal environmental law including, among others, the Clean Water Act, is an ARAR, and that any state requirement that is more stringent than the federal one is an ARAR.

Washington State's Surface Water Cleanup Standards [WAC 173-340-730] specifically references both Section 304 of the Clean Water Act (CWA) and the National Toxics Rule (40 C.F.R. Part 131) (NTR) at WAC 173-340-730(3)(b)(i)(C). MTCA stipulates that surface water cleanup levels shall be at least as stringent as the CWA and NTR. Therefore, the National Toxics Rule (NTR) is applicable at the Holden Mine Site to the extent the NTR values were promulgated when the MTCA regulations were last updated (2001). To the extent any newer (post-2001) NTR values exist, they would be potentially relevant and appropriate for the Site per WAC 173-340-710(4).

Unique comment(s) addressed:

TGAR01-59, TGAR03-04

Comment and Response: 10-135

Comment:

The commenter said identification of the NWQC as an ARAR is erroneous.

Response:

In determining whether the NWQC are relevant and appropriate under the circumstances of the release at a particular site, CERCLA requires that the Agencies consider the designated or potential use of the surface water or groundwater, the environmental media affected, the purposes for which such criteria were developed, and the latest information available, 42 U.S.C. § 9621(d)(2)(B)(i). On this basis the NWQC have been determined to be relevant and appropriate for this Site in accordance with CERCLA.

MTCA specifically indicates the NWQC are applicable to establishing surface water cleanup levels "... unless it can be demonstrated that such criteria are not relevant and appropriate for a specific water body or hazardous substance" [WAC 173-340-730(3)(b)(i)(B)]. As with the NTR, the NWQC values would thus be applicable at the Site (subject to the "unless it can be demonstrated" language) to the extent the values were published when the MTCA regulations were last updated (2001). To the extent any newer (post-2001) NWQC values exist, they would be potentially relevant and appropriate for the Site per WAC 173-340-710(4). The Agencies' March 6, 2003, letter to Intalco presents examples of possible exceptions that may lead the Agencies to not adopt an NWQC value as a cleanup level at the Holden Site. To this point, as further discussed in the comment response below, Intalco has not demonstrated that any criterion qualifies for such an exception.

Unique comment(s) addressed:
TGAR01-60

Comment and Response: 10-136

Comment:
The 1999 NWQC are not applicable under MTCA; MTCA states CWA criteria should be considered only to the extent that they are relevant and appropriate for specific surface water body or hazardous substance. Intalco has documented the NWQC for iron and aluminum are outdated and/or based on species that do not inhabit Railroad Creek, thus they are not relevant or appropriate under CERCLA.

Response:
The Agencies have determined that the NWQC for iron and aluminum are relevant and appropriate for Railroad or Copper Creeks under CERCLA and MTCA. Although some sensitive organisms used in the derivation of specific NWQC are species not native to Railroad Creek, these species are appropriate surrogate species for untested species present in Railroad Creek. In the absence of site-specific studies or other information on species native to Railroad Creek, these surrogate receptors represent the range of possible biological responses to contaminants. Additional analysis that the NWQC are relevant and appropriate is presented in USFWS (2004 and 2005).

Unique comment(s) addressed:
TGAR01-60a

Comment and Response: 10-137

Comment:
The 1999 NWQC are not applicable under MTCA. (Future requirements cannot be incorporated by reference into regulations in Washington State.). The 2004/2006 NWQC are not applicable under MTCA because future requirements cannot be incorporated by reference into regulations.

Response:
The 1999 NWQC criteria are applicable to protection of aquatic life at the Site [WAC 173-340-730(3)(b)(i)(B)], as these were the NWQC criteria when the MTCA regulations were last updated in 2001. Even if not applicable, the 1999 criteria are relevant and appropriate for protection of aquatic life under MTCA [WAC 173-340-710(4)]. The 2004/2006 NWQC and subsequent NWQC (such as the 2007 copper criterion) are relevant and appropriate for protection of aquatic life under MTCA [WAC 173-340-710(4)].

Regardless, the more stringent standard, including NWQC, is an ARAR under CERCLA, 42 U.S.C. § 9621(d)(2)(A)&(B).

Unique comment(s) addressed:
TGAR03-03, TGAR01-60b

<u>Comment and Response: 10-138</u>

Comment:
Ecology adopted marine criteria less stringent than the NTR in 1997; this demonstrates that the more stringent NWQC are not relevant and appropriate to the waters of Washington State.

Response:
On November 18, 1997, Washington adopted revised chronic marine aquatic life criteria for copper and cyanide, the only two marine aquatic life priority toxic pollutants in the NTR applicable to Washington. These revisions included a chronic marine aquatic life water quality criterion for copper for all marine waters and a site-specific chronic cyanide criterion for Puget Sound. EPA approved these criteria on February 6, 1998. On August 1, 2003, Washington adopted revisions to its water quality standards, including a chronic marine criterion for cyanide for all marine waters except Puget Sound. EPA approved this criterion on May 23, 2007. The adoption of the marine criteria met with EPA approval under the Clean Water Act and the regulations known as the National Toxics Rule. This process, which specifically addressed marine (salt) waters, does not demonstrate that the NWQC are not relevant and appropriate to freshwater at the Holden Mine Site.

Unique comment(s) addressed:
TGAR01-60c

<u>Comment and Response: 10-139</u>

Comment:
A technical impracticability (TI) waiver is justified since background conditions of aluminum and cadmium seasonally exceed the NWQC.

Response:
The background concentrations for aluminum and cadmium were selected based on the lowest chemical-specific ARAR value identified, or background concentrations (if higher). Background concentrations for aluminum and cadmium were used to select cleanup levels in accordance with WAC 173-340-720(7)(c). No TI waiver is necessary. See also, Washington's antidegradation policy, WAC 173-201A-300. The Agencies do not agree that the basis for a TI waiver has been established, and, therefore, such a waiver would not be approved prior to implementing the remedy.

Unique comment(s) addressed:
TGAR01-60d

Comment and Response: 10-140

Comment:
Local laws are not ARARs under either MTCA or CERCLA. Remedial action would only be required to comply with the substantive requirements of those local laws that are implemented as one of the identified state laws listed in RCW 70.105D.090 and WAC 173-340-710(9)(b) or a law requiring or authorizing local government permits or approvals for the remedial action.

Response:
The Comment refers to potential ARARs that were discussed in 2005. This comment on the Proposed Plan was incorporated by reference at Intalco's request from a document that Intalco originally submitted in 2006. The ROD presents the final ARARs and TBCs that the Selected Remedy must attain (except where waived). There are no local laws listed as ARARs in the ROD.

Unique comment(s) addressed:
TGAR03-01

Comment and Response: 10-141

Comment:
The 2004 NRWQC are not relevant or appropriate under CERCLA. (See Section 3 and Appendix B of the DFFS, and Hansen 2005 for additional discussion of Intalco's legal and technical rationale).

Response:
The Agencies have previously responded in detail to this comment and to the documents cited in the comment. See, for example, the Agencies' letter dated September 7, 2007, to David Jackson, Project Coordinator for Intalco, that transmitted a study completed by the U.S. Fish and Wildlife Service that addressed Intalco's comments. See also the Agencies' comment no. 151 on the DFFS (Forest Service 2007a) that notes that the NWQC are based on ecological risk assessments, and that analyses by the Fish and Wildlife Service (USFWS 2004 and 2005) confirm the appropriateness of the NWQC for the Site based on CERCLA Section 121(d)(2)(B), 42 U.S.C. § 9621(d)(2)(B).

Unique comment(s) addressed:
TGAR03-02

Comment and Response: 10-143

Comment:
MTCA Method A is not an ARAR. (The site does not meet the requirements for a MTCA Method A cleanup. This issue was resolved as documented in the Agencies' response to Intalco's June 4 letter regarding ARARs, dated July 28, 2003 (Forest Service 2003a)).

Response:
The Agencies concur, and note that this comment on the Proposed Plan was incorporated by reference at Intalco's request from a document that Intalco originally submitted in 2006.

Unique comment(s) addressed:
TGAR03-05

Comment and Response: 10-144

Comment:
Washington State MCLs are not applicable. (Groundwater is not a "public water supply" under the Safe Drinking Water Act or WAC 246-290- 020.)

Response:
Washington State MCLs are applicable at the Site. Groundwater at the Site meets the definition of a potential groundwater source [WAC 173-340-720(2)] and, therefore, beneficial use for groundwater at the Site includes using it as a potential source of drinking water [WAC 173-340-720(1)(a)]. At Lucerne, which is downgradient of the former mine and is included within the Site, groundwater is a current source of drinking water.

Primary Maximum Contaminant Levels (MCLs) under WAC 246-290-310 and the federal Safe Drinking Water Act (SDWA, 42 U.S.C. § 300f-j) are relevant and appropriate in accordance with CERCLA, 42 U.S.C. § 9621. WAC 173-340-720(1) directs that groundwater cleanup levels be based on protecting groundwater as a drinking water source, in addition to other requirements.

Unique comment(s) addressed:
TGAR03-06

Comment and Response: 10-145

Comment:
The protection of surface-water values included in the Agencies' Table 2-3 [in the 2005 NRRB submittal package] are not ARARs, they are screening values only.

Response:
The Comment refers to potential chemical-specific ARARs for groundwater and surface water that were discussed in 2005, and the Agencies do not agree that these are only screening values. This comment on the Proposed Plan was incorporated by reference at Intalco's request from a document that Intalco originally submitted in 2006. The ROD presents the final ARARs and TBCs that the Selected Remedy must attain (except where waived), which includes many of the same ARARs cited in 2005. The Selected Remedy was evaluated under both CERCLA and MTCA criteria, and was evaluated for attainment of ARARs as described in Section 13.2 of the ROD.

Unique comment(s) addressed:
TGAR03-07

Comment and Response: 10-146

Comment:
Requirements under WAC 173-340-760 are not ARARs or TBCs for sediment. (They are not promulgated standards and bioassays conducted on Railroad Creek and Lake Chelan sediment show no remedial action is needed. Moreover, MTCA does not include specific provisions for

sediment cleanup. Section WAC 173-340-760 merely references the Washington State SMS regulations (WAC 173-204) which state that freshwater sediment issues will be addressed on a case-by-case basis).

Response:
It is correct that no statewide numeric freshwater sediment standards currently have been promulgated by Washington State. However, the State Sediment Management Standards (Chapter 173-204 WAC) do apply to freshwater sediments and are treated on a case-by-case basis. The regulations, therefore, are cleanup criteria for the Holden Mine Site (see WAC 173-340-760, WAC 173-204-1 10[6] and WAC 173-204-340). The Sediment Management Standards (Chapter 173-204 WAC) are currently being updated, in part, to include more explicit language regarding freshwater sediments. Existing state freshwater criteria (Michelsen 2003) and freshwater guidance are also being updated. These authorities provide a basis to assess the protectiveness of the remedy. The Selected Remedy relies on this approach until such time as numeric and bioassay criteria can be promulgated.

Sediment evaluations to date are inconclusive, the science and regulations for sediment evaluation and management has evolved over the many years that cleanup action on this Site has been delayed, and sediments will incur ongoing impacts until both Phase 1 and 2 of the Remedial Action are completed. Therefore, the Agencies anticipate delaying further sediment monitoring until after the remedy is complete.

The use of numeric sediment quality guidelines (i.e., metals concentrations in sediment) developed from freshwater environments across the state are unlikely to accurately predict the presence or absence of toxicity in sediments where water quality or provenance of sediments differs from those in the original data set used to develop the guidelines. Bioassays are required to assess sediment quality where these conditions are likely to affect availability of contaminants in sediments. Conditions warranting bioassay analyses include where one or more water chemistry parameters (e.g., pH, hardness, dissolved inorganics, dissolved nutrients) is outside the ranges seen in the initial data set or the sediments are partly made of, or affected by, leachates and/or precipitates from mine tailings or drainage, (see Ecology 2011).

The need for remedial actions to protect receptors from concentrations of hazardous substances in sediment at the Site that exceed cleanup levels is addressed in the final Feasibility Study, and appropriate bioassay criteria to achieve this are summarized in Table 7 in the ROD.

Unique comment(s) addressed:
TGAR03-08

Comment and Response: 10-147

Comment:
Aquatic Lands Management laws are not ARARs for remedial actions involving Railroad and/or Copper Creeks under MTCA. (Requirements under the Aquatic Lands Management law are only applicable to state-owned lands. None of water bodies associated with the Site is a state-owned aquatic land as they are not "navigable waters." These regulations are not "relevant and appropriate" to non-state-owned aquatic lands as the requirements do not meet the threshold for relevance.

Response:
Aquatic lands are to be managed to promote uses and protect resources as specified in the regulations. The Agencies do not accept that Railroad Creek is not a navigable water, but regardless, the aquatic lands management laws and regulations address problems that are sufficiently similar to those encountered at the Site that they are relevant and appropriate to the remedial actions that will be implemented to protect Railroad Creek and other surface waters at the Site. This comment on the Proposed Plan was incorporated by reference at Intalco's request from a document that Intalco originally submitted in 2006; final ARARs are discussed in the ROD.

Unique comment(s) addressed:
TGAR03-09

Comment and Response: 10-148

Comment:
The substantive requirements of the state Water Code and Regulation of Public Ground Waters of Washington State-Surface and Groundwater Withdrawal (RCW 90.03 and 90.44) are not ARARs.

Response:
The Agencies agree that Chapters 90.03 and 90.44 RCW are not ARARs to the extent that contaminated surface water and groundwater is being diverted and extracted solely for the purpose of treating such water to cleanup levels prior to discharge into Railroad Creek. Such treatment does not constitute a "beneficial" use of the water triggering the requirements of Chapters 90.03 and 90.44 RCW.

Unique comment(s) addressed:
TGAR03-10

Comment and Response: 10-149, 10-150, 10-151, 10-152 and 10-153

Comment:
The Agencies' definition of the term "ARAR" is overly broad and vague and does not correspond to CERCLA definition (i.e., does not reflect "promulgation," does not reflect association with release of "hazardous substance," etc.) (sic).

The Agencies cite the CERCLA definition of the term "applicable requirements," yet do not use precise CERCLA language. (Under the NCP, applicable requirements are defined as: "those cleanup standards, standards of control and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance found at a CERCLA site" [40 C.F.R. § 300.5.)

The Agencies cite the CERCLA definition of the term "relevant and appropriate requirements," yet do not use precise CERCLA language. (Under the NCP, relevant and appropriate requirements are defined as: "those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site, address problems or situations sufficiently *similar to those encountered at the CERCLA site that their use is well suited to the particular site" [40 C.F.R. § 300.5]).*

The Agencies' definition of the term "chemical-specific ARAR" is overly broad and vague. (Chemical-specific ARARs are health-based or risk-based numerical values or methodologies, which when applied to site-specific conditions, result in establishment of numerical values. The values establish the acceptable amount or concentration of a hazardous substance that may be found in or discharged to the environment.)

The Agencies provide an inadequate definition of the term "location-specific ARAR." (Potential location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because the substances occur or activities are conducted in specified locations. These requirements may limit the type of potential remedial action that can be implemented or may impose additional constraints on remedial alternatives.)

Response:
The comments refer to a discussion of potential ARARs that was presented to Intalco in 2005. These comments on the Proposed Plan were incorporated by reference at Intalco's request from a document that Intalco originally submitted in 2006. The ROD presents the final ARARs and TBCs that the Selected Remedy must attain. The Agencies' definition of ARARs is consistent with the NCP.

Unique comment(s) addressed:
TGAR03-11, TGAR03-12, TGAR03-13, TGAR03-14, TGAR03-15

<u>Comment and Response: 10-155</u>

Comment:
Under CERCLA, state regulations are potential ARARs only to the extent the specific requirements are identified by the state in a timely manner.

Per WAC 173-340-702, when evaluating cleanup actions performed under the federal cleanup law, only specific provisions of MTCA are potentially applicable [i.e., 173-340-350 (RI/FS), -355 (remediation levels), -357 (risk assessment), -360 (selection of cleanup action), -410 (compliance monitoring), -420 (periodic review), -440 (Institutional controls), -450 (releases from underground storage tanks), -700 through 760 (cleanup standards, and -830 (analytical procedures).)

Response:
The ROD presents ARARs for the Site based on both CERCLA and MTCA.

- Development of potential ARARs is an iterative process. The Forest Service, the lead agency for the Site, believes that Ecology timely identified state ARARs.

- MTCA is the State of Washington's cleanup law and much of it is applicable to the release and remedial action at the Site, not limited to the sections cited in the comment. The Holden cleanup is a MTCA action under the state's independent jurisdiction, as well as a CERCLA action.

Unique comment(s) addressed:
TGAR03-17

Comment and Response: 10-156

Comment:
It should be noted that MTCA does not have a TBC criterion.

Response:
Comment noted.

Unique comment(s) addressed:
TGAR03-18

Comment and Response: 10-157

Comment:
Aluminum (Al) and iron (Fe) are not listed as hazardous substances under CERCLA and MTCA and, therefore, there is no requirement to address these constituents.

Response:
The iron and aluminum compounds identified at the Site are hazardous substances. The Agencies determination that these iron and aluminum compounds are hazardous substances was presented by USDA (2006) based on information that Intalco presented in the DRI.

Unique comment(s) addressed:
TGAR03-19

Comment and Response: 10-158

Comment:
Jurisdiction under the Fish and Wildlife Coordination Act (16 U.S.C. §§ 661-667) is limited to impoundments of greater than 10 acres. For many of the alternatives under consideration, the total surface area disturbed would be less than 10 acres.

Response:
The remedial alternatives referred to, that involved disturbance of less than 10 acres, were rejected in the final Feasibility Study because they did not satisfy the threshold requirements for selection of a permanent remedy. Even if less than 10 acres were involved, the Fish and Wildlife Coordination Act may well be relevant and appropriate, although it may not be applicable. The Fish and Wildlife Coordination Act is an ARAR for the Selected Remedy as indicated in the ROD.

Unique comment(s) addressed:
TGAR03-20

Comment and Response: 10-159

Comment:

The applicability of the Fish and Wildlife Conservation Act (16 U.S.C. §§ 2901 -2911) is not related to actions but to potential impacts to non-game fish and wildlife.

Response:

The Agencies agree that the Fish and Wildlife Conservation Act is related to potential impacts on non-game fish and wildlife. The requirements of this act, however, are applicable to remedial activities, including actions in Railroad Creek that could affect Lake Chelan. Disturbance of the Railroad Creek during remedy implementation has the potential to impact non-game fish and wildlife within Railroad Creek and Lake Chelan.

Unique comment(s) addressed:

TGAR03-21

Comment and Response: 10-161

Comment:

The Washington State Shoreline Management Act is not an ARAR for portions of Railroad Creek adjacent to federal lands. (Under WAC 173-27-060(2)(b) (sic), federal agencies are not required to obtain permits for developments undertaken by the federal government on lands owned in fee by the federal government. The only segment of Railroad Creek that is not adjacent to federal lands is located within the Garretson Lode Patented Mining Claim. The Garretson Load Claim encompasses the portion of Railroad Creek from just downstream of SP-26 to just upstream of the confluence of the portal drainage channel and Railroad Creek.)

Response:

Upon approval by the Department of Ecology, Chelan County's Master Program became enforceable as a state law requirement under Washington's Shoreline Management Act (SMA), Chapter 90.58 RCW. See RCW 90.58.090; *Citizens for Rational Shoreline Management v. Whatcom County,* No. 84675-8, 2011 WL 3612312, at 3 (Wash. Aug. 18, 2011).

The SMA is applicable to all non-federal lands within the Holden Mine Site. Further, while the specific provision ("WAC 173-27-060(2)(b)," does not appear in the version of WAC 173-27-060 last amended in 1996), the Agencies note that WAC 173-27-060(3) provides:

> The policies and provisions of chapter 90.58 RCW, including the permit system, shall apply statewide to all nonfederal developments and uses undertaken on federal lands and on lands subject to nonfederal ownership, lease or easement, even though such lands may fall within the external boundaries of a federal ownership.

See also, RCW 37.08.220 (state has asserted concurrent jurisdiction over non-federal activities on federal lands acquired by purchase or gift within the National Forest System).

Even if the Holden Mine cleanup is considered a "federal activity," the requirements of Chelan County's Master Program, as requirements of the SMA, are still relevant and appropriate requirements for the cleanup (e.g., wetland buffer areas, setbacks, etc.).

Unique comment(s) addressed:
TGAR03-23

Comment and Response: 10-162

Comment:
Substantive compliance with the Chelan County Shoreline Management Plan is not required under WAC 173-27-060(2)(b) for actions on federal land. Under CERCLA, substantive compliance with local regulations is not required since local requirements are not included in the definition of ARAR in the NCP.

Response:
Under the Shoreline Management Act [RCW 90.58], state-approved local shoreline master programs are enforceable as requirements of state law. RCW 90.58.090; *Citizens for Rational Shoreline Management v. Whatcom County,* No. 84675-8, 2011 WL 3612312, at *3 (Wash. Aug. 18, 2011). As such the Chelan County Shoreline Management Plan is an ARAR under both CERCLA and MTCA.

Unique comment(s) addressed:
TGAR03-24

Comment and Response: 10-163 and 10-165

Comment:
The identification of Subtitle C Hazardous Waste Management (40 C.F.R. Parts 261 to 279) as an ARAR is too broad. (Most of the requirements under the Resource Conservation and Recovery Act regulations are not potential ARARs for the Site. The potential requirements should be specifically defined by the Agencies as identified in the DFFS Section 3.3.4.)

The description of Washington State Hazardous Waste Management Act and Dangerous Waste Regulations (RCW 70.105; Chapter 173-303 WAC) as ARARs is overly broad and vague. (Most of the Washington State dangerous waste regulations are not potentially applicable to the Site. The potentially applicable requirements are identified and described in the DFFS Section 3.3.4 [WAC 173-303-016, -070, -071, and -090 through 104, -170, -200, -630, -640, 646(4), -646(5), -646(8)]. Additionally, these potential requirements only apply to materials which are "actively managed". As presented in the DFFS, off-site activities must comply with requirements of all applicable regulations, including WAC 173-303-060, -140, -141, -1 80, -1 90, -21 0, -220, and -240.)

Response:
The specific requirements of 40 C.F.R. Parts 260 to 279, RCW 70.105; and Chapter 173-303 WAC are ARARs that will be evaluated during Remedial Design and/or remedial action (e.g., when the mill building is demolished) to determine whether Subtitle C hazardous wastes are present, and if so, how to manage these wastes to satisfy ARARs. Also certain requirements such as 40 C.F.R. § 264.95 relating to points of compliance for groundwater at waste management areas are relevant and appropriate.

Unique comment(s) addressed:
TGAR03-25, TGAR03-27

Comment and Response: 10-164

Comment:
The identification of Subtitle D Managing Municipal and Solid Waste (40 C.F.R. Parts 257 and 258) as an ARAR is overly broad and vague. 40 C.F.R. Part 258 covers municipal solid waste landfills and is neither applicable nor relevant and appropriate to the Site. Only the limited guidelines regarding "closure" of 40 C.F.R. Part 257 are potentially relevant and appropriate.

Response:
The specific requirements of 40 C.F.R. Parts 257 to 258 are ARARs that will be further evaluated during Remedial Design and/or remedial action for solid wastes that need to be managed or will be generated during implementation of the Selected Alternative.

Unique comment(s) addressed:
TGAR03-26

Comment and Response: 10-168

Comment:
Specific regulatory requirements for Section 401 Water Quality Certification (33 U.S.C. §1341) are not identified. (As described in Section 3.3.10 of the DFFS, substantive compliance with 33 U.S.C. § 1341 (a) and (d) and WAC 173- 225-010 is required if a federal permit requirement is identified as ARAR. This requirement is potentially applicable to remedial alternatives involving dredge and fill requiring Section 404 permit equivalency or point source discharge under an NPDES permit equivalency.)

Response:
Implementation of the Selected Remedy will need to comply with the CWA sections cited in the comment along with other sections in the manner specified during remedial design.

Unique comment(s) addressed:
TGAR03-30

Comment and Response: 10-169

Comment:
Long-term stormwater runoff at the facility is not subject to stormwater NPDES requirements as it is not an "industrial activity." On-site construction activities greater than 1 acre will meet the substantive requirements of USEPA's general NPDES stormwater, construction permit requirements.

Response:
Treatment facilities constructed at the Site are subject to stormwater NPDES substantive requirements and CERCLA, Forest Service, and MTCA requirements. Construction activities will also need to meet state stormwater management substantive requirements and CERCLA, Forest Service, and MTCA requirements.

In non-impacted areas, the construction stormwater general permit substantive requirements may be sufficiently protective. However, strict adherence to these same substantive requirements is not sufficiently protective of surface water bodies receiving discharge from contaminated areas (e.g., tailings and waste rock). Therefore, additional BMPs, monitoring, and discharge requirements will be applied to discharges from these areas to ensure protection of aquatic resources.

Unique comment(s) addressed:
TGAR03-31

Comment and Response: 10-170

Comment:
The applicability of Section 404 of the CWA should be reviewed in light of recent judicial decisions, including United States Supreme Court decisions. Agencies should also include the use of substantive requirements of nationwide permits to address remedial action at the Site. The substantive requirements of nationwide permits have been used for previous actions at the Site and should be considered for future remedial actions.

Response:
Comments noted. The comments refer to a discussion of potential ARARs that was presented to Intalco in 2005. These comments on the Proposed Plan were incorporated by reference at Intalco's request from a document that Intalco originally submitted in 2006. The references to Supreme Court decisions and nationwide permits do not specifically relate to the Proposed Plan, and, therefore, do not enable a detailed response.

Regardless, Section 404 is, at minimum, relevant and appropriate to the Selected Remedy, in accordance with Section 121(d)(2)(A) of CERCLA, 42 U.S.C. § 9621 (d)(2)(A).

Unique comment(s) addressed:
TGAR03-32

Comment and Response: 10-171

Comment:
Intalco is not aware of any potential ARARs specifically required under the CAA. Reference to the CAA as an ARAR is overly broad and vague and does not provide any reference to a requirement which must be met.

Response:
The CAA provides a framework designed to protect ambient air quality. It and the Washington Clean Air Act and implementing regulations are an ARAR that requires compliance with emissions (e.g., from heavy equipment during construction), and control measures to prevent fugitive dust from becoming airborne.

Because the Site is located within the Glacier Peak Wilderness Area Class 1 Airshed, specific air quality ARARs need to be addressed under the Clean Air Act (42 U.S.C. § 7401 et seq.; 40 C.F.R. Part 50) and related regulations to satisfy both the National Ambient Air Quality Standards and the Prevention of Significant Deterioration and Visibility Regulations

Unique comment(s) addressed:
TGAR03-33

Comment and Response: 10-172

Comment:
Reference to SEPA as an ARAR is overly broad and vague. The SEPA review is an administrative requirement that is met through implementation of the CERCLA and MTCA process.

Response:
The Agencies agree SEPA is not an ARAR and it is not identified as such in the ROD. SEPA provides Ecology with substantive authority, subject to certain provisions, to modify a proposed cleanup action to mitigate adverse environmental impacts (RCW 43.21C.060; WAC 197-11-660); (RCW 43.21C.036; WAC 197-11-250).

Unique comment(s) addressed:
TGAR03-34

Comment and Response: 10-173

Comment:
Natural background metals concentrations for Yakima Basin soils are TBCs, but only if site- specific background values are not identified.

Response:
The comments refer to a discussion of potential ARARs that was presented to Intalco in 2005. These comments on the Proposed Plan were incorporated by reference at Intalco's request from a document that Intalco originally submitted in 2006. The comment has been superseded by Intalco's collection of site-specific background samples. Yakima Basin soil background metals concentrations are not considered as TBCs in the ROD.

Unique comment(s) addressed:
TGAR03-35

Comment and Response: 10-175

Comment:
MTCA soil cleanup levels are not ARARs for tailings or waste rock piles. (The Agencies indicate that MTCA, [including (WAC) 173-340-740, -745, -747, and -7490 through -7494], is applicable to soils across the Site, including the tailings and waste rock piles. As discussed in Section 3 of the DFFS, soil cleanup values are not applicable or relevant and appropriate to the tailings and waste rock piles. Tailings and waste rock piles will comply with the relevant and appropriate requirements associated with solid waste closure and post-closure provisions of Chapter 173-350 WAC.)

Response:
The comment is incorrect. Tailings and waste rock are considered to be soils for the purpose of establishing cleanup levels. WAC 173-340-200 defines soil to be "a mixture of organic and inorganic solids, air, water, and biota that exists on the earth's surface above bedrock, including materials of anthropogenic sources such as slag, sludge, etc."

Unique comment(s) addressed:
TGAR03-37

Comment and Response: 11-1 and 40-2

Comment:
Several comment writers expressed concern that the challenges of the remote location and climate of the Holden Mine Site be taken into consideration for the design, construction, and maintenance of the overall remedy and its components.

Some comments suggested those designing and implementing the remedy should experience the travel and weather challenges posed by the Site.

Some comments also suggested that those designing and implementing the remedy should seek low technology, durable solutions appropriate for the project environment (e.g., temperature swings, snowfall) and location (extended power outages, need for waste minimization, possible extended maintenance/repair intervals).

Response:
Representatives of Intalco who will be involved in the design, construction, and maintenance of the remedy, and the representatives of the Agencies who will be responsible for review and oversight of remedy implementation have traveled to the Site, and are knowledgeable and familiar with the challenges associated with the Site's remote location, accessibility, and weather. These and other issues will be given appropriate consideration during Remedial Design and implementation.

The Selected Remedy incorporates groundwater treatment technology and other components that are well proven in cleanup of other sites, as discussed in the SFS and ASFS (Forest Service 2007b and 2010a).

Unique comment(s) addressed:
MSCH01-06, HVWC05-06, HVWC06-04, TSAN01-01, MSCH01-04

Comment and Response: 11-2

Comment:
Fire is a potential significant risk. One comment writer encouraged the Agencies to share plans with Holden Village as soon as possible so Holden Village can participate and prepare any expectations. Also, if there is a fire in the valley and residents are forced to evacuate, would this mean a 2-year construction program would potentially extend into 3 years?

Response:
Holden Village representatives have participated in discussions involving identification and evaluation of remedial alternatives throughout the RI/FS process. The Agencies will continue to coordinate with Holden Village during Remedial Design and construction planning, and thereafter.

Intalco is developing construction schedules as part of remedial design. These include periods of interim construction and what is anticipated to be two years of major construction. As currently envisioned, a second phase of construction would occur five years later, as explained in the ROD.

The Agencies acknowledge the comment is correct that circumstances could extend the construction period.

As stated in Section 4.3 of the ROD, the Agencies understand that Holden Village has concerns for the viability of its operations if remedial construction results in closure or significantly constrains operations of the Village for more than two consecutive years, or if there is a second closure within five years of the conclusion of the first construction period. Intalco will develop a proposed remedy construction schedule, subject to Agency approval. The Agencies will strive to ensure that the schedule is consistent with the expressed preferences of Holden Village. Circumstances may interfere with achieving this goal, however.

Unique comment(s) addressed:
JPIE01-02

<u>Comment and Response: 12-1</u>

Comment:
The Proposed Plan specifies that drinking water standards will be applied to all groundwater outside the tailings piles footprints, including immediately adjacent to tailings piles. Holden Village's perspective is that this is unnecessary and punitive. Drinking water from other sources is abundant in Railroad Creek Valley. Groundwater quality will be significantly improved from its current conditions by the remedy, meaning there will be no future threat to drinking water.

Response:
The Agencies have identified drinking water standards as a basis for cleanup of groundwater at the Site in areas that are not located within WMAs. The Agencies acknowledge that groundwater is not currently used for drinking water by Holden Village and understand that Holden Village currently has no plans for using groundwater. However, the groundwater at the Site is a valued resource of the United States and the State of Washington and is used as a drinking water source at Lucerne. The Agencies are obligated to carry out cleanup actions that restore contaminated groundwater to beneficial uses.

This concept is summarized in the EPA guidance document, "Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration" (EPA 2009). As explained in this document, the goal of cleanup actions at Holden and other sites includes cleaning up current or potential drinking water aquifers to levels protective of drinking water users by attaining drinking water standards. Under federal cleanup requirements, the determination of what constitutes a "current or potential drinking water aquifer" is to be guided by state environmental requirements so long as the state's requirements are as stringent as EPA's. In Washington, all groundwater is considered to be a potential source of drinking water, except under very specific limited circumstances that do not exist at the Holden Site (WAC 173-340-720(1)(a)). Therefore, for the purposes of environmental cleanup, all groundwater at the Site that lies outside of a designated WMA is considered a potential drinking water resource and cleanup goals must include drinking water standards.

Unique comment(s) addressed:
HVWC01-08

Comment and Response: 12-2

Comment:

Intalco disagrees with the Agencies' interpretation of MTCA that groundwater must meet surface water protection criteria before discharging to surface water. Agencies have considerable flexibility to institute practical, site-specific performance objectives (e.g., recovery of habitat and native species) and should not use generic concentration-based standards.

Response:

Regarding the first part of the Comment:

- Under MTCA, groundwater cleanup levels are established in accordance with WAC 173-340-720.

- These groundwater cleanup levels must be at least as stringent as concentrations protective of surface water in situations where hazardous substances are likely to reach surface water without cleanup actions being implemented (WAC 173-340-720(3)(b)(iv) and WAC 173-340-720(4)(b)(ii)). The RI (Dames and Moore 1999) clearly shows that hazardous substances are reaching surface water and will continue to do so in the absence of cleanup actions.

- Under MTCA, groundwater cleanup levels—including those based on surface water criteria—must be met at the standard point of compliance, "throughout the Site," unless it is not practicable to meet the cleanup level throughout the Site within a reasonable restoration time frame [WAC 173-340-720(8)(c)]. As demonstrated in the DFFS (URS 2004), it is not practicable to meet cleanup levels beneath the tailings piles and waste rock piles within a reasonable time frame. In this situation, MTCA allows for the establishment of a conditional point of compliance and indicates that this conditional point of compliance "shall be as close as practicable to the source of hazardous substances," provided that all practicable methods of treatment are used in the site cleanup [WAC 173-340-720(8)(c)]. The establishment of such a conditional point of compliance requires a demonstration that among other things, it is not practicable to meet the cleanup level within the groundwater before it enters surface water. The Agencies have determined that cleanup levels can be achieved within groundwater beyond the containment area (through the use of groundwater barrier walls). Under MTCA this determination requires that groundwater cleanup levels established for the protection of aquatic life must be met at a conditional POC within groundwater before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates.

- At Holden, it is practicable to meet cleanup levels at a point within groundwater beyond the barrier walls, prior to discharge to surface water. As such the criteria for a conditional POC under WAC 173-340-720(8)(d)(i) do not apply. Rather, the groundwater conditional point of compliance is established under WAC 173-340-720(8)(c).

Regarding the second part of the Comment:
Compliance with concentration-based standards is a key component of remedy selection and performance under both MTCA and CERCLA. Under MTCA, a remedy must comply with cleanup

standards (consisting of numeric cleanup levels combined with a point of compliance); under CERCLA, a remedy must comply with ARARs, including numeric chemical-specific ARARs. This information is presented in Sections 10.1 and 10.2 of the ROD.

Moreover, in accordance with CERCLA Section 121(d)(2)(A) [42 U.S.C. § 9621(d)(2)(A)], and the NCP, groundwater at the Site must be restored to meet MCLs – MCLs are relevant and appropriate requirements at this Site. The NCP provides that groundwater will be returned to its beneficial uses (including MCLs) within a reasonable restoration time frame wherever practicable [40 C.F.R. § 300.430(a)(1)(iii)(F)]. Although the point of compliance for groundwater cleanup under CERCLA is generally throughout the contaminated plume, the NCP recognizes that remedies may involve areas where waste materials will be managed in place. Such areas are referred to as WMAs.

The Agencies have determined that certain groundwater source areas at the Site, including Tailings Piles 2 and 3, if contained or managed, can be considered WMAs. This is because available information indicates that it will be hundreds of years before groundwater below the tailings and waste rock piles achieves cleanup levels (see Appendix E of the DFFS, URS 2004). Also, during the development of alternatives, relocation of the tailings piles was not considered practicable. Because no alternative was identified that could clean up groundwater beneath the tailings piles and waste rock piles, the tailings piles and waste rock piles will continue to serve as a source of contamination to groundwater [see Section 3.1 of the SFS (Forest Service 2007) for a discussion of why source depletion is not an acceptable alternative]. When restoration of groundwater is not practicable, it is necessary to prevent further migration of the plume and to prevent exposure to the contaminated groundwater [40 C.F.R. § 300.430(a)(1)(iii)(F)]. Thus, groundwater containment is a necessary aspect of a WMA so that contaminants do not migrate.

The Agencies identified on-Site WMAs to address non-attainment of potential groundwater ARARs within the WMAs, see Section 2.5 of the ASFS (Forest Service 2010a). The Site WMAs are shown in the ROD on Figure 14. Without containment, MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3 unless ARARs were met beyond the tailings piles and an ARAR waiver was determined appropriate for MCLs in groundwater beneath the tailings piles. So long as groundwater is managed, the point at which groundwater must achieve cleanup levels is at and beyond the edge of the WMA (55 Fed. Reg. 8753, and 53 Fed. Reg. 51426).

The Selected Remedy will contain and capture the groundwater within the WMAs. With the barrier and thus, the WMA, groundwater must achieve MCLs at and beyond the edge of the WMA (55 Fed. Reg. 8753, and 53 Fed. Reg. 51426) rather than throughout the plume.

Under CERCLA, cleanup levels based on protection of surface water must be met before groundwater enters Railroad Creek downgradient of Tailings Piles 2 and 3. CERCLA requires consideration of the state's stream classification for protection of site-specific uses that could be impacted by groundwater discharging into the surface water (see WAC 173-201A-600). At a minimum, this includes preventing receptors in the creek from being exposed to groundwater that exceeds aquatic life protection criteria and meeting drinking water standards by controlling hazardous substances before they enter the surface water (see the NCP preamble [55 FR 8713]). Thus, for the purpose of protection of surface water, standards must be met before receptors are exposed within the hyporheic zone.

Unique comment(s) addressed:
MWHA01-19

Comment and Response: 12-3

Comment:
Groundwater cleanup standards should protect the groundwater-to-surface water pathway, and the depth and lateral extent of the hyporheic zone should be determined at and near site and treated as surface water. "Groundwater" immediately adjacent to and beneath creeks at the Site is essentially surface water and should be regulated on that basis to the extent of contamination (i.e., at least as far as 7-mile Creek).

Response:
The Agencies agree that cleanup of the Site must address the groundwater-to-surface water pathway and must protect surface water, including the hyporheic zone. To that end, the ROD establishes groundwater cleanup levels that are based on the protection of surface water (based on protection of aquatic life) and requires the establishment of points of compliance that will assure that protection is achieved. The cleanup will involve the development and implementation of a compliance monitoring plan that will monitor groundwater at location(s) between the contaminant sources and surface water so that groundwater quality can be evaluated before it discharges to surface water; thus providing assurance that cleanup levels for protection of surface water are reached in groundwater prior to the portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates.

Unique comment(s) addressed:
HVWC01-04

Comment and Response: 13-1

Comment:
The commenter asserts that the groundwater barrier proposed downgradient of Tailings Piles 2 and 3 should be a potential contingent action rather than a component of the base selected remedy. CERCLA provides the Agencies with the opportunity to assess the performance of any remedy and to require additional measures if it is not meeting the objectives (i.e., compliance monitoring and five-year review). Instead of including the Tailings Pile 2 and 3 barrier wall as part of the base remedy with an "opt-out" clause, the Agencies should incorporate language that states that "as part of the Compliance Monitoring Plan to be developed during Remedial Design, protocols will be developed to establish if the remedy is meeting the performance objectives and, if the remedy is deemed to be non-compliant, for identifying the cause of the non-compliance and the appropriate corrective measures." Additional remedial components would be added incrementally if the remedy is not meeting performance objectives.

Response:
The Selected Remedy includes all the components necessary to address the releases of hazardous substances at the Site, based on existing data. The final Feasibility Study concluded that a groundwater barrier downgradient of Tailings Piles 2 and 3 would be needed to be protective of surface water before contaminated groundwater enters Railroad Creek. There is no basis in the

final Feasibility Study to conclude that the groundwater barrier downgradient of Tailings Piles 2 and 3 should be a potential contingent action rather than a component of the base selected remedy.

Unique comment(s) addressed:
MWHA01-08/12; INTA01-07/20

Comment and Response: 14-1

Comment:
Several comments were received suggesting that there is inconsistency or ambiguity in the Proposed Plan regarding the conditions under which the Phase 2 barrier wall would not need to be installed or that its design could be modified. The comments indicated that there was confusion over whether the "trigger" was to be, 1) the actual attainment of ARARs (e.g., surface water cleanup levels) within three years of remedial implementation, or 2) the demonstration—within three years—that there was a sustainable trend that indicated that ARARs would be attained within a reasonable restoration time frame.

Response:
The ongoing release of hazardous substances from the tailings piles to groundwater has created an ongoing adverse impact to aquatic receptors in Railroad Creek and a risk to human health. This ongoing release is a direct threat that must be addressed in a timely manner.

The Agencies' intent is that the "trigger" for not installing the second groundwater barrier would involve demonstrating to the Agencies' satisfaction that:

1. Groundwater concentrations are reduced to achieve surface water cleanup levels before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates; and
2. One of the following: a) groundwater meets MCLs below Tailings Piles 2 and 3, as well as throughout the plume; or b) groundwater that exceeds drinking water standards will be contained within a WMA; or c) an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective is justified.

Such a change would require a ROD Amendment. The basis for the change must be demonstrated within three years of substantial completion of the first phase of remedial construction, so that a decision can be made in the fourth year. Unless the second phase groundwater barrier and collection system is eliminated, the second phase of remedial action is expected to be designed in the fifth year and constructed immediately thereafter.

Unique comment(s) addressed:
HVWC02-15, MWHA01-14, MWHA01-15 (second part), INTA01-14, HVWC01-11, URSC07-41, URSC07-51, URSC07-39, TGAR01-29

Comment and Response: 14-2

Comment:
Several comments were received questioning why a three-year monitoring period was selected by the Agencies for evaluating if the Phase 2 barrier wall would not need to be installed or if its design

could be modified. Some of these comments suggested that a much longer period (e.g., 10 years) would be needed to make this determination.

Response:
At least some of these comments appear to have arisen from a misinterpretation of whether monitoring is needed to demonstrate the groundwater containment barrier and collection system does or does not need to be installed, indicating that up to 10 years or longer may be required for the "full effect" of remediation to be seen.

The Agencies do not believe that it is necessary or desirable to wait for the full effect of remediation to be established before installing the Phase 2 barrier wall. As discussed in the ROD, the Agencies' believe there are sufficient data to show that groundwater containment and treatment downgradient of Tailings Piles 2 and 3 is needed to protect Railroad Creek. Further, MCLs are not likely to be met under Tailings Piles 2 and 3 within a reasonable restoration timeframe, and containment is necessary for a WMA, which allows for a point of compliance at and beyond the edge of the WMA. Without containment, there can be no WMA, and MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3, or there would need to be an ARAR waiver for MCLs based on technical impracticability from an engineering perspective, which, if justified, would require a ROD Amendment. Such an ARAR waiver would not be approved unless the remedy was shown to be protective, including the protection of aquatic life where groundwater discharges to surface water, and the establishment of institutional controls to prevent use of groundwater for drinking water below the tailings piles.

The Agencies' commented on the likely results of monitoring over time following implementation of the first phase groundwater barrier and collection system in Section HTM-14 of a June 1, 2010, document (USFS 2010b).

Intalco's analysis, presented in the Draft Alternative 13M Evaluation Report, concluded that a period of 2 to 10 years would be required to evaluate the effect of the remedy on groundwater quality downgradient of Tailings Piles 2 and 3. The Agencies noted several technical deficiencies in Intalco's analysis and concluded that effects of remedial actions should be apparent in groundwater at the downgradient edge of Tailings Pile 3 earlier than this. For example, travel time estimates made by the Agencies using Intalco's calibrated groundwater flow model indicated that effects of the initial phase of remediation would be seen within one to three years.

The travel time estimate presented by Intalco assumed that the effects of remediation would not be apparent until groundwater traveled from the west side of Tailings Pile 2 to monitoring well SG-10 (located downgradient 4,550 feet to the east). However, the Agencies noted that it would not be necessary for effects to be observed at SG-10 before evidence of the effectiveness of the remedy to be observed. Wells at the eastern margin of Tailings Pile 3 at the edge of the WMA are roughly 1,800 feet closer to the tailings pile sources than SG-10. If Intalco's supposition (that Phase 1 of the remedy will eliminate the need for Phase 2) holds true, observed changes in groundwater quality at the eastern margin of Tailings Pile 3, and below the Tailings Piles 2 and 3, should be evident significantly sooner than Intalco's analysis suggested.

Some comments suggest that travel time should be estimated to SG-10 (presumed by the comments to be the nearest groundwater conditional point of compliance) because that is where ARARs would need to be met for the wall to not be required. As stated above, the Agencies understand these comments to be based on a misunderstanding of the intended trigger requirements and believe that observations of trends toward compliance can and should appropriately be observed as close to the source as possible as provided in WAC 173-340-720(8)(c).

Similar comments suggested that the Agencies' travel time estimate may be too short because it is based on Intalco's estimates of hydraulic conductivity from aquifer tests rather than more integrated estimates of conductivity derived from the groundwater flow model and that the Agencies' estimate does not take into account infiltration time. The Agencies note that their estimate did use the estimate of hydraulic conductivity derived from Intalco's model, but point out that using some of Intalco's measured data would lead to even shorter travel times. In addition, the Agencies note that Intalco's data show a very rapid response in groundwater elevation in response to spring recharge events (see Section E-2.2.3 in Intalco's Draft Alternative 13M Evaluation Report) (ERM and URS 2009) that may indicate very rapid infiltration into the tailings piles compared to the overall travel time estimate.

Moreover, under CERCLA, ARARs that must be met by the Selected Remedy include MCLs in groundwater throughout the Site, unless there is containment at the WMA boundaries. Without containment, there can be no WMA, and MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3, or there would need to be an ARAR waiver for MCLs based on technical impracticability from an engineering perspective, which, if justified, would require a ROD Amendment. Such an ARAR waiver would not be approved unless the remedy was shown to be protective, including the protection of aquatic life where groundwater discharges to surface water, and the establishment of institutional controls to prevent use of groundwater for drinking water below the tailings piles.

Unique comment(s) addressed:
HVWC02-14, URSC07-48, URSC07-49, URSC07-50, MWHA01-15 (first part), INTA01-08, INTA01-10, TGAR01-09, PHAI03-03

Comment and Response: 14-3

Comment:
Several comments were received suggesting that the Phase 2 barrier would not—or may not—be necessary to achieve cleanup goals and/or suggesting that there is not currently enough information on which to base the decision.

Response:
The data collected by Intalco to date are insufficient to demonstrate that cleanup goals would be achieved without Phase 2 of the remedy (containment and treatment of groundwater impacted by releases from Tailings Piles 2 and 3). The data show that groundwater beneath these tailings piles is impacted by hazardous substances and this groundwater will continue to discharge to Railroad Creek unless it is controlled. Groundwater discharges to the creek downgradient of Tailings Pile 3 exceed cleanup levels protective of aquatic life. Refer to the final Feasibility Study (ASFS Section 6.2.2.1) for a more detailed discussion.

The Agencies understand that Intalco maintains that the first phase of the remedy may be adequate to protect Railroad Creek. Under CERCLA, however, ARARs that must be met by the Selected

Remedy include MCLs in groundwater throughout the Site, unless there is containment at the WMA boundaries. So long as groundwater is managed within WMA, the point at which groundwater must achieve cleanup levels is at and beyond the edge of the WMA (55 Fed. Reg. 8753, and 53 Fed. Reg. 51426). Without containment, there can be no WMA and MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3, or there would need to be an ARAR waiver for MCLs based on technical impracticability from an engineering perspective, which, if justified, would require a ROD Amendment. Such an ARAR waiver would not be approved unless the remedy was shown to be protective, including the protection of aquatic life where groundwater discharges to surface water, and the establishment of institutional controls to prevent use of groundwater for drinking water below the tailings piles. The ROD allows for the collection of additional data following implementation of the first phase cleanup components, and includes the provision that the barrier wall would not need to be installed or that its design could be modified, if it can be demonstrated after the first phase of the remedy that:

1. Groundwater concentrations are reduced to achieve surface water cleanup levels before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates; and
2. Either a) groundwater meets MCLs below the tailings piles, as well as throughout the plume; or b) groundwater that exceeds drinking water standards will be contained within a WMA; or c) an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective is justified.

Unique comment(s) addressed:
HVWC04-02, TGAR01-25, TGAR01-22, INTA01-09, WGID02-03, WPQA01-05, WGID01-03

Comment and Response: 14-4

Comment:
Several comments were received making the point that there are uncertainties regarding some aspects of the second phase groundwater barrier and collection system, related to implementability, effectiveness, and cost; whether performance of the second phase barrier could be adequately monitored and assessed.

Response:
Regarding the implementability and effectiveness of the groundwater barrier, in the final Feasibility Study (see Appendix C of the SFS, USFS 2007b), the Agencies conducted an extensive review that documents the implementability and effectiveness of groundwater barrier walls installed in combination with groundwater collection systems at more than a hundred sites over the past 25+ years as part of containment and remediation systems. During this process the Agencies interviewed EPA Project Managers and others responsible for cleanup at 48 sites where groundwater barriers have been used as part of remediation. Based on large number of sites where barrier walls have been successfully used to contain groundwater as part of remedial actions, the Agencies consider this technology would be implementable and effective as part of a cleanup action at the Holden Site.

Under both CERCLA and MTCA, cost is not one of the threshold criteria for selection of a final remedy. The final Feasibility Study (see Appendix A of the ASFS, Forest Service 2010a), presented a cost estimate for the groundwater barrier wall that was based on Intalco's own cost estimates (ERM and URS 2009). The Agencies acknowledge that there is uncertainty in this cost estimate because it was prepared during the feasibility study stage of the cleanup process, prior to remedial design. EPA guidance (EPA 2000) recognizes the inherent uncertainty in cost estimates made at this stage of the process and suggests the level of certainty of such estimates should be within a range of - 30 percent to + 50 percent of the final cost of implementing the remedial action. Such estimates are considered to be adequate for remedial decision making. Remedial design will enable greater specificity on details of the remedy and allow for more precise cost estimates.

Assessment of the performance of the second phase groundwater barrier would not be particularly difficult or impossible, as suggested by some of the comments. A fully penetrating barrier wall, and associated groundwater collection and treatment system, would capture the contaminants in groundwater from Tailings Piles 2 and 3 and prevent the contaminated groundwater from discharging into Railroad Creek. The performance of such a system would be assessed by monitoring the concentrations of contaminants in groundwater downgradient from the wall, and monitoring groundwater and surface water points of compliance (including conditional points of compliance) farther down valley. The details of such a monitoring program will be specified during Remedial Design and documented in a compliance monitoring plan.

Unique comment(s) addressed:
MWHA01-30, INTA01-16, TSMI01-02

Comment and Response: 14-5

Comment:
Monitoring for surface water compliance should focus on surface water, not groundwater.

Response:
Where groundwater discharges to surface water, groundwater monitoring for compliance with surface water standards is mandatory. Under MTCA, groundwater cleanup levels are established in accordance with WAC 173-340-720. These groundwater cleanup levels must be at least as stringent as concentrations protective of surface water in situations where hazardous substances are likely to reach surface water [WAC 173-340-720(3)(b)(iv), WAC 173-340-720(4)(b)(ii]. In addition, both CERCLA and MTCA require protection of all affected media and receptors, including those aquatic receptors using the interface between groundwater and surface water [WAC 173-340-700(6)(b)]. Under MTCA a conditional point of compliance for groundwater at the Site must be as close as practicable to the source [WAC 173-340-720(8)(c)], and can be no farther from the source than within the surface water as close as technically possible to the point or points where groundwater flows into the surface water [WAC 173-340-720(8)(d)(i)].

In the case of this Site, under MTCA the conditional point of compliance must be within groundwater before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates. Under CERCLA, the preamble to the final NCP [55 FR 8753] states that groundwater remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the WMA when the waste is left in place (see also 53 FR 51426). In relation to protection of surface water "EPA's policy is to attain ARARs...so as to ensure protection at all points of potential exposure" [53 FR 51440]. Under CERCLA, protection of surface water receptors is based on the State of Washington's designated beneficial uses of the surface water. To ensure protection of surface water receptors, the point of compliance must be before the points of potential exposure for the beneficial uses of surface water for aquatic life protection; before the groundwater-surface water interface.

The RI/FS shows that hazardous substances are reaching surface water through groundwater and will continue to do so in the absence of cleanup actions. Groundwater cleanup levels must be met "throughout the site," unless it is not practicable to meet the cleanup level throughout the site within a reasonable restoration time frame [40 C.F.R. § 300.430(a)(1)(iii)(F) and WAC 173-340-720(8)(c)]. As demonstrated in the final Feasibility Study, it is not practicable to meet cleanup levels beneath the tailings piles and waste rock piles within a reasonable time frame. Therefore, WMAs have been identified in these areas and groundwater must meet MCLs at and beyond the edge of the WMA, unless groundwater meets MCLs downgradient of the tailings piles and an ARAR waiver for MCLs beneath the tailings piles is justified on technical impracticability from an engineering perspective.

In this situation, MTCA allows for the establishment of a conditional point of compliance and indicates that this conditional point of compliance "shall be as close as practicable to the source of hazardous substances," provided that all practicable methods of treatment are used in the site cleanup [WAC 173-340-720(8)(c)].

In certain circumstances, MTCA allows the establishment of a conditional point of compliance that is as close to the contaminant source as practicable but not farther than "within the surface water as close as technically possible to the point or points where groundwater flows into the surface water" [WAC 173-340-720(8)(d)(i)]. Establishment of such a conditional point of compliance requires a demonstration that, among other criteria, it is not practicable to meet the cleanup level within the groundwater before it enters surface water. At Holden, it is practicable to meet cleanup levels at a point within groundwater beyond the barrier walls, prior to discharge to surface water. As such, the criteria for a conditional POC under WAC 173-340-720(8)(d)(i) do not apply. Rather, the groundwater conditional point of compliance is established under WAC 173-340-720(8)(c). A remedy that does not contain groundwater in these areas, such as Alternative 13M would not satisfy AKART as required by WAC 173-340-720(8)(d)(i).

Unique comment(s) addressed:
TGAR01-30

<u>Comment and Response: 14-6</u>

Comment:
The Agencies have not demonstrated that the Phase 2 barrier wall would achieve measurably better water quality in Railroad Creek.

Response:
Hazardous substance concentrations in groundwater discharging into Railroad Creek as a result of releases from Tailings Piles 2 and 3 are several times surface water cleanup levels. For examples and additional discussion see Figures 6 and 7 and Section 6.2.2.1 of the ASFS (Forest Service 2010a). The Agencies have concluded that the data collected by Intalco to date are insufficient to demonstrate that cleanup goals would be achieved without control of the groundwater impacted by releases from Tailings Piles 2 and 3.

The groundwater barrier and collection system described in Alternatives 11M and 14 are well suited for this part of the remedy, since this technology has been demonstrated to be effective at a large number of other CERCLA sites (see Appendix C of the SFS, Forest Service 2007b).

Moreover, under CERCLA, ARARs that must be met by the Selected Remedy include MCLs in groundwater throughout the Site, unless there is containment at the WMA boundaries. Without containment, there is no WMA and MCLs must be achieved throughout the Site.

Unique comment(s) addressed:
TGAR01-03

Comment and Response: 14-7

Comment:
There has not been a careful evaluation of whether a partially penetrating barrier wall or fully penetrating barrier wall would be better.

Response:
The Agencies previously proposed a partially penetrating barrier as part of Alternative 10 that was analyzed in the final Feasibility Study (see Forest Service 2007b). The final Feasibility Study feasibility concluded there was not sufficient information in the Administrative Record file to conclude that Alternative 10 would meet the threshold requirements for selection of a final remedy under CERCLA and MTCA. Intalco has had the opportunity to further evaluate a partially penetrating barrier, but chose not to do so. Nevertheless, Intalco continues to have the opportunity for such an evaluation, and may propose modifying the Selected Remedy to include a partially penetrating barrier through an Explanation of Significant Differences (ESD) or ROD Amendment.

Because of the phasing of the remedy, Intalco has an opportunity to collect additional data and conduct further evaluations prior to the installation of the Phase 2 groundwater barrier wall. The Phase 2 groundwater barrier wall would not need to be installed or its design could be modified if demonstrated to satisfy ARARs and be protective within a timeframe comparable to the Selected Remedy. The second phase of the remedy would not need to be installed only if it can be demonstrated to the Agencies' satisfaction that:

1.) Groundwater concentrations are reduced to achieve surface water cleanup levels before that portion of the hypoheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates; and
2.) One of the following: a) groundwater meets MCLs below Tailings Piles 2 and 3, as well as throughout the plume; or b) groundwater that exceeds drinking water standards will be contained within a WMA; or c) an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective is justified.

Unique comment(s) addressed:
TGAR01-27

Comment and Response: 18-1

Comment:
Several comments stated general concerns with the plans to relocate Railroad Creek, with regards to erosion, environmental impacts, and should incorporate features such as wide drops or ponds for the safety of visitors and residents.

Response:
The Agencies are in full agreement with the concerns regarding the relocation of Railroad Creek. Erosion control and prevention are being considered along with other issues to assure the new creek channel performs similar to upstream and downstream reaches. The new Railroad Creek channel will eliminate problems that occur with the existing channel that was constructed during mining (e.g., the section relocated by the miners is too straight and relies on deteriorated bulkheads for stability in some reaches). Minimizing the environmental impact in the relocation corridor is also a priority. Intalco and the Forest Service have begun work on some biological baseline studies of the proposed impact area. Design objectives for the relocated creek will include the restoration of the natural conditions and physical characteristics associated with Railroad Creek. The Agencies are sensitive to the safety and well-being of all visitors to the creek and will consider safety during Remedial Design and construction. However, special safety features to reduce creek flow, or other features not present in the undisturbed reaches of Railroad Creek, are not anticipated to be incorporated in the design.

Unique comment(s) addressed:
RDUN01-04, EALL01-01, JMAT01-03-05, PJAM01-03-04

Comment and Response: 18-2

Comment:
Some comments expressed praise of the Agencies for the development of a plan to relocate Railroad Creek in an effort to reduce the biological and water quality impacts from the tailings piles.

Response:
Thank you very much. The relocation plan, coupled with the groundwater barrier walls, is intended to protect Railroad Creek from instability of the tailings piles, as well as prevent inflow of groundwater containing hazardous substances that adversely impact aquatic life and stream channel habitat. It will also eliminate continued exposure to the existing ferricrete in the stream channel.

Unique comment(s) addressed:
WDAL01-01, WDAL02-01

Comment and Response: 18-3

Comment:
Several comments were received expressing concern over the stability and erosion potential of the relocated stream reach and suggesting that there could be excessive sedimentation and/or unwanted erosion in the vicinity of Holden Village or the Holden-Lucerne Road.

Response:
The Agencies will provide technical oversight to assure that Intalco accomplishes the design and construction of a new stable channel. Since the current stream channel adjacent to the mine was relocated by the Howe Sound without the benefit of modern engineering and geomorphological science, the relocated stream reach is expected to be an improvement over the existing channel. The new channel will be designed to be more stable and less erosive than the existing channel, to provide aquatic habitat and riparian connectivity, and to maintain sufficient velocity to avoid excessive sedimentation.

Unique comment(s) addressed:
RDUN01-04, EALL01-01, JMAT01-05

Comment and Response: 18-4

Comment:
Page 37 of the Proposed Plan indicates that one purpose of the relocation of Railroad Creek is to reduce the risk of "erosion or scour" of the tailings piles. Please delete this phrase because this can be accomplished without relocating the creek. Revise the remaining language to read "to provide access for construction of potential tailings pile slope stabilization measures and groundwater containment and/or collection facilities." This properly reflects the dual purpose of the relocation.

Response:
The Agencies agree that relocation of Railroad Creek will provide needed access for construction of tailings pile slope stabilization measures and groundwater containment and/or collection facilities. However, relocation of the creek channel and/or moving the toe of the tailings piles away from the Creek are also needed to protect the tailings against erosion and scour.

Unique comment(s) addressed:
INTA01-26

Comment and Response: 18-5

Comment:
Two comments were received expressing concern over the loss of habitat along the alignment of the relocated reach of Railroad Creek.

Response:
The Agencies recognize that creation of the relocated stream reach will have some impact to terrestrial habitat; however, the overall long-term benefits of the cleanup to the environment far outweigh these impacts. An important design criterion will be to limit impacts to valuable habitat.

In addition, the Selected Remedy provides for restoration of areas disturbed by remedy implementation. The intent is also that the relocation result in improved habitat connectivity by providing complex structural habitat on both sides of the creek rather than just one side as is the current situation. The design will rely on existing habitat mapping that has been conducted by the Forest Service and Intalco and possibly on additional habitat surveys, if required.

Unique comment(s) addressed:
JMAT01-04, PJAM01-04

Comment and Response: 18-6

Comment:
Several comments were received supporting channel relocation as a good way to address mine-related impacts to the Railroad Creek.

Response:
Thank you for the comment. The Agencies believe that relocation of Railroad Creek as part of the Selected Remedy, based on Alternative 14, is the best way to accomplish the remedial action objectives.

Unique comment(s) addressed:
WDAL01-01, WDAL02-01, WPQA01-10

Comment and Response: 19-1

Comment:
Some comments expressed support for the Agencies preference for hydropower (or other alternative energy) to meet energy requirements for Alternative 14 instead of petroleum-based fuels to the extent possible.

Several of these comments expressed the opinion that use of hydropower or other alternative energy sources should be a mandatory part of the remedy.

Response:
Comments noted. The Agencies preference for hydropower for remediation at the Holden Mine Site is based on several of the TBC criteria relevant to remedy selection and implementation, see Table 22 of the ROD. The TBC criteria presented in the ROD will be used as part of implementing the Selected Remedy.

Although remedy implementation will rely on hydropower to the extent practicable, there will still be a need for some petroleum-based fuels or other forms of energy to operate heavy equipment. Inclusion of EPA's green remediation policies and other guidance as TBCs will minimize the adverse effects of petroleum-based fuels as part of remedy implementation to the extent practicable.

Unique comment(s) addressed:
HOGR01-02, KSAL01-02, BOLS01-03, BSAK01-02, CCAL01-03, CCAR01-05, CSCH01-04, DGWI01-04, HVWC06-03, FPOS01-02, HBMC02-03, KROH01-02, MMAN01-03, PHAI01-02, POLS01-02, PONE01-02, TWAG02-06, HVWC06-02

Comment and Response: 20-1

Comment:
Several comments indicated the remedy should include development of a fish hatchery on Railroad Creek for the enhancement of salmon and trout species.

Response:
A fish hatchery would not reduce or eliminate the release of hazardous substances into Railroad Creek, so it is not part of any remedial alternative that was identified.

A fish hatchery is a matter that could be considered by Intalco and the Natural Resource Trustees for the Holden Site as part of settling claims for injury to natural resources. (The Holden Trustees include the Forest Service, the State of Washington, the Yakama Nation, and the US Fish and Wildlife Service). The resolution of natural resource damage claims is separate from the remedial action ROD.

Unique comment(s) addressed:
HOGR01-04, KROH01-03, WPQA01-03, TRAN01-04

Comment and Response: 21-1

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that noted that the cost estimates for the proposed quarry location at Tenmile Creek for both Alternatives 11 and 13M would need to be adjusted in the event an alternative quarry location is selected by the Agencies.

Response:
Thank you for your comment. The Agencies agree that once a quarry location is determined by the Agencies, the cost estimates used in the final Feasibility Study may need to be updated.

Unique comment(s) addressed:
URSC09-02

Comment and Response: 21-2

Comment:
One comment indicated that concentrations along Railroad Creek shown in the Alternative 13M report (ERM and URS 2009) that were represented as lines connecting data points were not interpolations, but illustrate changes that may not be easily seen using a scatter plot.

Response:
Thank you for the clarification.

Unique comment(s) addressed:
URSC07-05

Comment and Response: 21-3

Comment:
One comment provided some rationale for analytical methods used for surface water samples in the Alternative 13M report (ERM and URS 2009). Staff gage samples collected in 2009 and reported in Table 3-7 of the Draft HTM Addendum were reanalyzed to achieve a lower reporting limit. A revised Table 3-7 was included in Attachment 2 to the comment. Conclusions of the Alternative 13M report were not affected.

Response:
Comment noted. The Agencies appreciate the clarification and the revised copy of Table 3-7.

Unique comment(s) addressed:
URSC07-42

Comment and Response: 21-4

Comment:
One comment clarified surface water concentrations at RC-4 between P-5 and RC-2 presented in the Alternative 13M report (ERM and URS 2009).

Response:
Response noted. Thank you for your clarification.

Unique comment(s) addressed:
URSC04-10

Comment and Response: 21-5

Comment:
One comment writer addressed the Agencies' prior comments (Forest Service 2010b) on Intalco's Draft Hydrogeologic Technical Memorandum (URS 2010) and noted that Intalco understands the distinction between the time period to implement a remedy and a reasonable restoration time frame. The writer noted that Intalco did not compare remedy implementation time at the Holden Mine site with the restoration time at other sites.

The comment writer indicated that remedial construction for Alternative 13M would require approximately 2 years of heavy construction. The contingent remedy evaluation time frame discussed in Section 4.6 of the Draft Hydrogeologic Technical Memorandum (i.e., a minimum of 10 years) refers to the length of time starting after remedial construction is complete before surface water and groundwater quality improvements are fully realized, though it is likely that continuous improvement will occur during this time frame. The construction of a second groundwater barrier wall was not included as part of the restoration time frame.

The writer indicated that Intalco compared what was termed the contingent remedy evaluation time frame estimated for the Holden Mine site with the "restoration time frame" and the "remedial action review time before considering a contingent remedy" for various other sites that were discussed by Intalco. The restoration time frames defined in the decision documents for the example sites were 10 to 30 years, or were uncertain. Thus for the example sites, evaluations were performed (typically every 5 years through the 5-year review process) for 10 to 30 years following remedy construction before evaluation of a contingent remedy was required. The writer noted that the adequacy of the remedy should be evaluated in 5-year cycles under the 5-year review process, and if it appears that Alternative 13M is not making sufficient progress towards meeting surface water cleanup levels after the 10-year anticipated restoration time frame, potential contingent actions could be discussed.

Response:
Information presented in the final Feasibility Study provides ample justification for implementation of the Selected Remedy (that is based on Alternative 14). The Agencies have determined it is appropriate to implement the Selected Remedy in two phases, solely to reduce the potential adverse impacts of construction on Holden Village.

The Agencies understand that Intalco maintains that the first phase components of the remedy may be adequate to protect Railroad Creek by themselves. The ROD allows for the collection of additional data following implementation of the first phase cleanup components and includes the provision that the Phase 2 barrier wall would not need to be installed or that its design could be modified if demonstrated to satisfy ARARs and be protective within a timeframe comparable to the Selected Remedy. The second phase of the remedy would not need to be installed only if it can be demonstrated to the Agencies' satisfaction that:

1.) Groundwater concentrations are reduced to achieve surface water cleanup levels before that portion of the hypoheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates; and
2.) One of the following: a) groundwater meets MCLs below Tailings Piles 2 and 3, as well as throughout the plume; or b) groundwater that exceeds drinking water standards will be contained within a WMA; or c) an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective is justified.

However, there is no reason to wait more than the five years to implement the second phase groundwater barrier and collection system, since this would unnecessarily extend the period of adverse impacts to aquatic life in Railroad Creek.

Unique comment(s) addressed:
URSC07-40

Comment and Response: 21-6

Comment:
One comment provided an explanation of 2005 v 2007 costs and cost conversions presented in Intalco's' cost estimate in support of the Alternative 13M report (ERM and URS 2009).

Response:
Comment noted. Thank you.

Unique comment(s) addressed:
URSC09-08

Comment and Response: 21-8

Comment:
One comment provided an explanation of why spring and summer 2009 data were submitted in the memo titled Fall 2009 Additional Sampling Recommendations. The data were included for reference because they influenced recommendations in the memo and no interim data submittal was required per the work plan.

Response:
Comment noted. Thank you.

Unique comment(s) addressed:
URSC05-02

Comment and Response: 21-9

Comment:
One comment provided errata on the human health risk assessment in the Alternative 13M report (ERM and URS 2009). The comment addressed the error and provided the corrected Table F-2-2.

Response:
Comment noted. Thank you for the corrected Table F-2-2.

Unique comment(s) addressed:
URSC08-05

Comment and Response: 21-10

Comment:
One comment clarified the reference to "Residual COPC concentrations" in the Alternative 13M report (ERM and URS 2009), as only intended to imply "remaining" COPC concentrations (i.e., concentration remaining following mill processing).

Response:
Comment noted.

Unique comment(s) addressed:
ERMW07-08

Comment and Response: 21-12

Comment:
One comment addressed a prior Agency comment on the Alternative 13M report (ERM and URS 2009), that noted: "During this spring sampling event, potential ARAR exceedances included cadmium, copper, and zinc at all sampled stations downstream of the portal drainage discharge (i.e., RC-4, RC-2, RC-10 and RC-3) and aluminum at RC-2."

In response the comment writer noted that reference to the portal drainage discharge was used strictly as a geographic reference in this statement.

Response:
Comment noted.

Unique comment(s) addressed:
URSC07-55

Comment and Response: 21-13

Comment:
One comment writer addressed the Agencies' prior comments (Forest Service 2010b) on Intalco's 2008 data collection effort that lead to development of the Alternative 13M report (ERM and URS 2009). The writer agreed that the 2008 data collection effort was designed by Intalco in part to address Agencies' concerns identified in 2007, and noted that the first complete sentence on the top of page F1-3 is the only instance within Appendix F of the Alternative 13M report that states that sample collection was requested by the Agencies.

Response:
Thank you for the clarification.

Unique comment(s) addressed:
URSC08-01

Comment and Response: 21-14

Comment:
One comment writer addressed the Agencies' prior comments (Forest Service 2010) on Intalco's Alternative 13M report (ERM and URS 2009) and provided corrected references [e.g., Raven et al. (1999); Pohl (1978); and Forest Service (2009)] The comment also clarified the reference to the Forest Service (2009) citation provided in Appendix and noted that the reference to Zabowski and Everett (1997) is correct.

Response:
Thank you for the clarification.

Unique comment(s) addressed:
ERMW07-31, ERMW07-32

Comment and Response: 21-15

Comment:
One comment writer addressed the Agencies' prior comments (Forest Service 2010b) on Intalco's Alternative 13M report (ERM and URS 2009). The comment writer noted that the Agencies' comment stated that the Agencies' March 11, 2008, letter (Forest Service OGC 2008) approved Intalco's request to collect additional Site data and perform additional analysis to support consideration of alternative remediation components proposed by Intalco.

Also the comment writer noted the Agencies' comment that the final cover for tailings and waste rock piles also needs to satisfy the requirements of the Forest Plan Standards and Guidelines and other potential ARARs, whereas the Agencies' expectations for performance objectives for caps over hazardous substances are presented in Appendix C of the ASFS.

Response:
Thank you for your comment.

Unique comment(s) addressed:
ERMW07-01, ERMW07-02, ERMW03-18

Comment and Response: 22-1

Comment:
Several comments addressed the Agencies' prior comments (Forest Service 2010b) on Intalco's Alternative 13M report (ERM and URS 2009), especially the Agencies' review of Appendix D titled Draft Proposed Railroad Creek Realignment Technical Memorandum. These comments state that additional data and analysis will be required during the remedial design phase for the Railroad Creek realignment. Specific data needs mentioned were: a detailed survey of Copper Creek; development of restoration and habitat measures in accordance with Washington State fish passage criteria; additional pebble counts, stream surveys, and grain size analysis of bulk sediment samples; additional field measurements, sediment loading evaluations, sediment sampling, and definition of sediment transport mechanisms; evaluation of the need for and design of an impermeable stream liner; and specific gradations of gravel filter material, riprap/channel armoring, and river gravel backfill to be used over the riprap.

Response:
The Agencies concur that additional data and analysis will be required as part of the design of the Railroad Creek relocation.

Unique comment(s) addressed:
URSC03-01, URSC03-02, URSC03-03, URSC03-04, URSC03 05, URSC03-06, URSC03-07

Comment and Response: 24-1

Comment:
The comment writer recommends use of a penetrating collection system upgradient/south of the tailings piles. This pollution prevention measure would divert clean water from tailings.

Response:
The Selected Remedy includes a swale for collecting and diverting surface water upgradient/south of the tailings and waste rock piles (or possibly a French drain) to divert clean stormwater run-on away from these areas.

Unique comment(s) addressed:
NPEC01-02

Comment and Response: 24-2

Comment:
The commenter had not seen reference to extraction wells as a technology for collection of groundwater for treatment. Commenter stated that it could eliminate some need for barrier walls but did recognize there were also issues with the power required to pump wells.

Response:
Groundwater extraction wells were one of the technologies screened out of the DFFS prepared by Intalco (URS 2004). Pumped wells were also proposed as part of Alternative 9, but this alternative

did not satisfy the threshold criteria for selection of a final remedy under CERCLA and MTCA. Groundwater extraction well technology was anticipated to be only moderately reliable in capturing the groundwater flow based on the heterogeneous subsurface conditions. Also the high iron content and acidic nature of the East Area groundwater would significantly increase operation and maintenance requirements and reduce system performance. The Agencies were not convinced that extraction wells would operate consistently and reliably in intercepting the contaminated groundwater under these conditions.

Unique comment(s) addressed:
RDUN01-05

Comment and Response: 24-3

Comment:
The commenter recommends use of a constructed groundwater collection system along the tailings piles rather than the existing creek channel and that all tailings piles be remediated in part by a penetrating groundwater collection system.

Response:
The Selected Remedy includes a conceptual design that will be further refined during design. Intalco's analysis for Alternative 13M predicted that the existing creek channel would be an effective groundwater collection system, and this approach was, therefore, adopted for Alternative 14 that became the basis for the Selected Remedy. However, if this approach is determined to be ineffective during Remedial Design and implementation, then an alternative approach would need to be developed and incorporated into the ROD through an ESD or ROD Amendment.

Unique comment(s) addressed:
NPEC01-01

Comment and Response: 24-4

Comment:
The comment points out that the Agencies' Alternative 11 does include containment of seeps SP-26 and SP-21. The comment states that Alternative 13M includes relocation of the creek and that seeps discharging from the tailings piles would be isolated from the relocated creek. The comment also states under Alternative 13M that these seeps would be monitored for comparison to post-remedy seep characteristics (e.g., flow and concentration).

Response:
The Selected Remedy, similar to Alternative 14, includes monitoring seep SP-26 and adjacent groundwater to determine whether groundwater in that area should be collected for treatment. The Selected Remedy also includes a groundwater barrier to eliminate the source of flow containing hazardous substances to seep SP-21. Under Alternative 13M, seep SP-21 would have discharged directly into the treatment system east of Tailings Pile 3.

Unique comment(s) addressed:
URSC07-35

Comment and Response: 25-1

Comment:
The commenter states that the spatial coincidence of contaminated shallow groundwater with surface water exceeding surface water criteria does not indicate that groundwater is the source of the surface water exceedances. Data indicate that groundwater discharges to Railroad Creek near station SG-10 but the writer believes the water quality data collected there with well points are suitable for screening purposes only.

Response:
Grab samples collected in-stream provide surface water data but do not characterize the conditions in the benthic zone where the groundwater discharges into the surface water. The Agencies do not agree that the well point data are inappropriate for use in either remedy selection or compliance monitoring. Additional data will need to be collected during baseline monitoring and following implementation of the remedy to evaluate shallow groundwater quality where potentially contaminated groundwater is known to discharge to surface water.

Unique comment(s) addressed:
URSC07-12, URSC07-01

Comment and Response: 25-2

Comment:
One comment writer addressed the Agencies' prior comments (Forest Service 2010b) on Intalco's Alternative 13M report (ERM and URS 2009). The Agencies' had commented that groundwater loading (groundwater flow and contaminant quantities discharging into surface water) has not been quantified sufficiently. The commenter stated that the Agencies were consulted frequently during development of the numerical groundwater flow model. The commenter also stated that contaminant inputs will be further characterized as part of the baseline monitoring program.

Response:
The Agencies provided technical review and comments during Intalco's groundwater model development; however, Intalco determined final modeling methods and input parameters that Intalco presented in the Alternative 13M report. The Agencies believe that groundwater loading has been adequately characterized for purposes of remedy selection, but that the data obtained do not support Intalco's assertion that natural attenuation is protective of Railroad Creek downgradient of Tailings Piles 2 and 3. The Agencies agree that data collected during the baseline monitoring will provide additional information for remedial design.

Unique comment(s) addressed:
URSCO07-15

Comment and Response: 25-3

Comment:
The comment writer states that tailings groundwater should be evaluated separately from alluvial groundwater, not combined in statistical calculations and other evaluations intended to represent underlying groundwater conditions.

Response:
Groundwater in the tailings is hydraulically connected to groundwater in the underlying alluvial aquifer and is a source of hazardous substances into the alluvial aquifer. It is appropriate to include hazardous substance concentrations measured in wells screened within the tailings in data analyses that represent contaminant concentrations in groundwater that eventually discharges to Railroad Creek.

Unique comment(s) addressed:
URSC06-01

Comment and Response: 25-4

Comment:
The commenter was responding to the Agencies' previous request for additional wells to be located downstream of well cluster DS-9 (in comments on the Alternative 13M report). The comment referred the Agencies to Intalco's 2010 Baseline Characterization and Monitoring Plan.

Response:
Thank you for your comments. The comment does not affect selection of a remedy.

Unique comment(s) addressed:
URSC07-06

Comment and Response: 25-5

Comment:
The comment writer does not support the barrier wall proposed around Tailings Piles 2 and 3. The comment states that mass loading of contaminants to the creek from groundwater beneath Tailings Piles 2 and 3 will be negligible and will not impact aquatic life, and that the contribution occurring today has no discernible effect on surface water quality. The comment writer provides plots comparing various metals data and field parameters collected at creek staff gauges and well points to support their argument.

Response:
The surface water samples that the comment refers to were grab samples collected within the stream and, therefore, do not represent groundwater conditions at the conditional point of compliance. Intalco's mass loading analysis relies on these surface water data and, therefore, is not conclusive about how conditions will change at the groundwater-surface water interface following implementation of the Selected Alternative.

Concentrations of hazardous substances measured in samples collected from well points and conventional monitoring wells downgradient of Tailings Piles 2 and 3 indicate groundwater concentrations exceed cleanup levels based on protection of aquatic life in Railroad Creek. The well point data provided by Intalco show elevated concentrations in shallow groundwater downstream of Tailings Pile 3, particularly at stations SG-9-WP through SG-12-WP in both the spring and fall, as well as farther downstream during low-flow conditions. Field parameters such as reduced pH and higher specific conductance reported at these stations also indicate contaminated groundwater is entering Railroad Creek. This release of groundwater above cleanup levels will be eliminated by construction of a groundwater barrier and collection system downgradient of Tailings

Piles 2 and 3, as demonstrated by barrier wall installations at numerous other sites (see Appendix C of the SFS, Forest Service 2007b).

Moreover, under CERCLA, ARARs that must be met by the Selected Remedy include MCLs in groundwater throughout the Site, unless there is containment at the WMA boundaries. Without containment, there can be no WMA and MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3, or there would need to be an ARAR waiver for MCLs for groundwater below Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective, which, if justified, would require a ROD Amendment.

Unique comment(s) addressed:
MWHA01-20

Comment and Response: 25-6

Comment:
The comment writer states that Tailings Pile 1 is the most significant source of aluminum but does not agree that it is the only source of aluminum and iron to groundwater as suggested in the Agencies' comments on the Alternative 13M report. The comment also points out that Intalco's loading analysis considers water quality downstream of Tailings Pile 3 at sampling locations RC-5A, RC-10, and RC-3, whereas the Agencies original comment referred to results of the 2008-2009 monitoring data.

Response:
Thank you for your comments. These comments do not affect selection of a remedy.

Unique comment(s) addressed:
URSC07-59

Comment and Response: 26-1

Comment:
The commenter questions the necessity of the Tailings Pile 2 and 3 barrier wall when groundwater downstream of the tailings piles is already below drinking water standards.

Response:
Although one purpose of the barrier wall is to assure that groundwater above drinking water standards is contained within the tailings pile WMAs, the barrier is also needed to prevent groundwater above aquatic protection levels from being discharged into Railroad Creek. Data presented in the final Feasibility Study (URS 2004) show groundwater impacted by releases from Tailings Piles 2 contains hazardous substances at concentrations above levels protective of aquatic life in Railroad Creek, and that this groundwater discharges into the creek. The Selected Remedy will prevent migration of hazardous substances that exceed cleanup levels in groundwater.

Unique comment(s) addressed:
MWHA01-17

Comment and Response: 26-2

Comment:
The comment writer questions why the Agencies are applying drinking water standards to groundwater downstream of the tailings piles. Drinking water standards seem excessive and cleanup to meet such standards entails greater environmental risk than benefit. The groundwater that provides drinking water to Lucerne is not contaminated, despite the lack of a mine site cleanup action for the 50+ years since the mine stopped operating.

Response:
Protection of groundwater for potential use as a drinking water source is the highest beneficial use (WAC 173-340-200). Washington groundwater protection regulations require the protection of existing and future beneficial uses of the groundwater through the reduction or elimination of discharge of contaminants [WAC 173-200-010]. Under MTCA groundwater on the Site is a future potential source of drinking water and must meet the cleanup criteria, unless this is technically impracticable. Similarly, Section 121(d)(2)(A) sets forth the CERCLA requirement that groundwater meet MCLs where relevant and appropriate, essentially, where it is potable but for contamination, as it is at the Site.

Unique comment(s) addressed:
HPQA01-03, TWAG02-05, HVWC01-09

Comment and Response: 27-1

Comment:
The comment writer expressed the opinion that the well point water quality samples should not be compared to ARARs, and that data from these samples may not be representative of groundwater conditions. The comment noted that some case studies have found that stainless steel well casings may leach cadmium, chromium, copper, and iron.

Response:
The Agencies understand the comment writer's concerns but note that relatively consistent groundwater quality data have been obtained from successive sampling vents using well points downgradient of Tailings Pile 3, that are consistent with sample results obtained from conventional monitoring wells, see Figure 9 in the ROD.

Unique comment(s) addressed:
URSC07-03, -04, -43, -12

Comment and Response: 28-1

Comment:
Several comments noted that the Proposed Plan and other documents refer to Holden Village as an "interdenominational religious retreat" and suggest a more accurate description would be a "Lutheran ministry and community."

Also the Proposed Plan refers to "Holden Village, Inc." The "Inc." was dropped from the corporate name in order to comply with state regulations. The comments requested that Holden Village be referred to only as "Holden Village" in the ROD and future documents.

Response:
Comments noted. The Agencies recognize Holden Village as both a community vested in the Lutheran community and a not-for-profit corporation. The ROD refers to both the community and the not-for-profit corporation of Holden Village simply as Holden Village.

Unique comment(s) addressed:
HVWC01-03, OMAT01-01, LCOL01-01, TWAG01-01, CHIN01-01, CKAI01-04, MMAN01-01, MWAG01-01, PHAI03-01

Comment and Response: 29-1

Comment:
Some comments questioned whether there might be some requests of Holden Village staff for future remedial monitoring or maintenance. One comment noted that partnership of the Village with the Forest Service for maintaining trails worked well, but another comment noted that Holden Village struggles to staff even their own immediate needs and added they are very limited in the ability to add tasks.

Response:
The Agencies have not requested Holden Village provide assistance other than occasional lodging for which Holden Village is reimbursed at commercial rates.

Monitoring and maintenance of the remedy are expected to be managed by Intalco with oversight from the Agencies. Intalco may request assistance from Holden Village due to Holden Village's continuous presence at the Site. Holden Village's role is not determined by the ROD.

Unique comment(s) addressed:
HVWC09-08, MSCH01-08, RDUN01-02, TRAN01-03

Comment and Response: 30-1

Comment:
The Proposed Plan refers to necessary infrastructure improvements to implement and operate the remedy, and noted that Holden Village's current infrastructure is in many regards inadequate to support remedy construction and long-term operation. Some comments expressed that Holden Village supports integrating its own infrastructure improvements with remedy construction. Otherwise two separate sets of infrastructure would result, which would be highly inefficient and more costly.

Response:
Comments noted.

Unique comment(s) addressed:
PHAI01-03, HVWC01-04

Comment and Response: 31-1

Comment:
Many comments provided numerous personal accounts of the value of Holden Village.

Response:
The Agencies understand and appreciate these comments. The Selected Remedy addresses these concerns through its Remedial Action Objectives, one of which says the remedy shall be implemented "in a manner that complies with ARARs and protects human health and the environment, including the Holden Village residential community during and after construction." The Agencies decided to implement remedial construction in two phases separated by a period of five years to reduce the potential impact of construction on Holden Village.

Unique comment(s) addressed:
AFCO01-02, BGAM01-02, CBRO01-01, CCAR01-02, CGIE01-03, CHIN01-03, CJNA01-01, CJOH01-01, CKAI01-06, COOC01-01, CSCH01-02, CWAG01-02, DBLO01-01, DELL01-01, DJOH02-01, DMFA01-01, DPET02-02, EJMA01-02, EREE01-01, FFEN01-02, GMAT01-01, HBMC01-04, HBMC02-01, HJOH01-02, JMAT01-01, JMCQ01-01, JQUE01-01, JSMI01-01, JSTA01-01, KSAL01-04, LCOL01-02, LGSP01-02, LLAN01-02, LROE01-03, MALL01-02, MLEE01-01, MMAN02-01, NMAT01-03, NSCH01-02, OMAT01-02, PAND01-01, PCPE01-02, PFRE01-02, PHIN01-02, PHIN02-01, PJAM01-02, POLS01-04, PTEL01-02, RCTR01-02, RDJE01-03, RMMO01-01, RPON01-02, SBAL01-02, SKRA01-02, SSTE01-01, TANE01-02, TWAG02-01, WGID02-06

Comment and Response: 33-1

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009). The comment asserted that correct application of background values was used in Intalco's analysis, but incorrect values were entered for arsenic, barium, and zinc. Although arsenic concentrations in soils from the tailings piles exceed background, a remediation level was not calculated because arsenic meets MTCA exclusion criteria for cleanup. No arsenic was detected in the waste rock piles.

Response:
The Agencies appreciate the corrections made to Table F2-3 and related tables, and concur with the MTCA exclusion for the evaluation of arsenic in the tailings piles.

Unique comment(s) addressed:
URSC08-06

Comment and Response: 33-2

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and defended Intalco's use of language used (e.g., "limited exceedances") as correct and appropriate.

Response:
The Agencies do not concur with certain characterizations made in Intalco's Draft Supplemental Human Health Evaluation for Tailings and Waste Rock Piles that may give the impression that specific remedial actions, cleanup requirements, or the cleanup decision process as a whole may be overly cautious or unnecessarily protective.

Unique comment(s) addressed:
URSC08-02

Comment and Response: 33-3

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and defended Intalco's history of soil sampling at the Site and human health risk conclusions for the tailings and waste rock piles.

Response:
The Agencies do not concur with Intalco's site investigation history as presented in the Alternative 13M Report (ERM and URS 2009). The Agencies raised concerns about human health exposure to tailings in their comments to the DFFS (Forest Service 2007a). Intalco's Alternative 13M evaluation did not completely address those concerns.

Unique comment(s) addressed:
URSC08-04

Comment and Response: 33-4

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and noted that Appendix F relates to materials in the tailings and waste rock piles only and not other components of the remedy such as treatment system pond excavation. This text was intended to identify why workers may be on the waste piles and ways they could be exposed to materials in the piles.

Response:
Comment noted.

Unique comment(s) addressed:
URSC08-07

Comment and Response: 33-5

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and noted that cleanup levels were not calculated, but only remediation levels for alternative reasonable maximum exposure scenarios. The comment asserted the methods used to calculate the remediation levels are appropriate.

Response:
The Agencies appreciate the additional evaluation provided in Intalco's Draft Supplemental Human Health Evaluation for Tailings and Waste Rock Piles (ERM and URS 2009). However, MTCA Method B methods for unrestricted land use must be used to calculate modified cleanup levels for the reasonable maximum exposure scenario for Holden Village and surrounding areas. Method B is appropriate for selection of permanent cleanup levels for this Site, since the Site does not meet the criteria for Methods A and C under MTCA, see WAC 173-340-704(1), WAC 173-340-705(1), and WAC 173-340-706(1).

Unique comment(s) addressed:
URSC08-11

Comment and Response: 33-6

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and asserted that overall, conservative estimates of exposure were used for the recreational exposure scenario (i.e., documented snow cover at Site from November to May). Decreasing worker exposure frequency would raise the remediation level and have no effect on conclusions. Since Appendix F is applicable only to tailings and waste rock piles under Alt. 13M, construction activities would not involve active tailings disturbances for 150 days per year. One comment noted that adjusting the worker exposure frequency would have no affect on Intalco's conclusions.

Response:
The Agencies understand the justifications presented for the exposure parameter values used in alternative exposure scenarios presented in Intalco's Draft Supplemental Human Health Evaluation for Tailings and Waste Rock Piles. However, MTCA Method B methods for unrestricted land use must be used to calculate modified cleanup levels for the reasonable maximum exposure scenario for Holden Village and surrounding areas. Method B is appropriate for selection of permanent cleanup levels, since the Site does not meet the criteria for Methods A and C under MTCA, see WAC 173-340-704(1), WAC 173-340-705(1), and WAC 173-340-706(1). Construction may well involve active tailings disturbances for more than 150 days per year, depending on Intalco's construction plans.

Unique comment(s) addressed:
URSC08-12, URSC08-15

Comment and Response: 33-7

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and noted Intalco cannot calculate a specific MTCA Method B value because there is no reference dose for lead. The comment defended Intalco's use of the EPA blood-lead modeling technique noting that it has a well documented history.

Response:
Comment noted. The Agencies evaluated human health risks from lead in soil using the MTCA Method A cleanup level for unrestricted land use of 250 mg/kg. This value is based on preventing

unacceptable blood lead levels. However, the Agencies note that soil cleanup requirements for lead in soil at the Site were based on cleanup levels associated with protection of terrestrial organisms (or background) which are lower than the Method A level. Use of a cleanup level based on protection of terrestrial receptors (0.43 to 0.93 mg/kg for different areas of the Site) is protective of human health.

Unique comment(s) addressed:
URSC08-14

Comment and Response: 33-8

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report supplemental human health risk evaluation (ERM and URS 2009). The original Agencies' comment stated that Intalco's use of a 200 mg/day soil ingestion rate was not appropriate for a maintenance worker exposure scenario and the value should be 100 mg/day (the MTCA default).

The comment stated that the 100 mg/day value was based on EPA's outdoor adult worker default value and not the MTCA default. The comment noted, however, that remediation levels based on the higher ingestion rate would still be greater than the highest concentrations observed within the upper 16 feet of the tailings and waste rock piles.

Response:
The Agencies understand Intalco's use of a soil ingestion rate of 100 mg/day for the maintenance worker exposure scenario. Intalco's Draft Supplemental Health Evaluation of the Tailings and Waste Rock Piles provides an analysis of the protectiveness of a specific remedial option for selected receptors and is not a determination of a cleanup action. However, cleanup actions at the tailings and waste rock piles are based on the MTCA Method B procedure.

Unique comment(s) addressed:
URSC08-13

Comment and Response: 33-10

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) regarding risk due to cadmium and arsenic. Cadmium and arsenic are the only inorganic COPCs with dermal absorption factors per EPA 2004. The arsenic screening value is based on background and is not affected by exposure pathways. The addition of the dermal pathway for cadmium will have no significant effect on the screening results. In addition, the screening values for cadmium and copper come from the SFS (Forest Service 2007b) and include the dermal pathway. The inhalation pathway contributions to exposure are insignificant compared to the ingestion pathway. Screening levels for inhalation are orders of magnitude higher (EPA's Regional Screening Levels) than for ingestion and the addition of the inhalation pathway do not influence screening results

Response:
The Agencies accept the justifications provided by Intalco concerning exclusion of the dermal and inhalation exposure pathways in calculating the screening values used to identify COPCs in the tailings and waste rock piles. The Agencies agree that since this appendix to the Alternative 13M report presents an analysis of the protectiveness of a specific remedial option and not a determination of a cleanup action, the analysis for this sole purpose does not need to comply with MTCA cleanup regulations. However, cleanup actions at the tailings and waste rock piles will need to comply with MTCA because Ecology is independently exercising MTCA authority at the Site and because certain MTCA provisions are ARARs under CERCLA.

Unique comment(s) addressed:
URSC08-09

Comment and Response: 33-11

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) regarding the use of dermal and inhalation pathways in screening levels. For remediation level calculations, Intalco followed EPA's recommendations and the dermal pathway is not included for copper or lead. Inhalation is included by default in the blood-lead model, but had no effect on the remediation levels.

Response:
The Agencies agree that the dermal and inhalation pathways are complete or potentially complete, but generally of minor importance compared to the ingestion pathway. Therefore, the human health conceptual site model (Figure F3-1) does not need to be modified.

Unique comment(s) addressed:
URSC08-10

Comment and Response: 33-12

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) regarding the use of MTCA statistics to identify chemicals for which a remediation level value could be determined. The comment asserted that this is an evaluation of protectiveness and not a determination of cleanup action, Intalco's use of the two times and 10 percent MTCA rule is not relevant for assessing human exposure to materials in the tailings and waste rock piles.

Response:
The Agencies agree that since this appendix to the Alternative 13M report presents an analysis of the protectiveness of a specific remedial option and not a determination of a cleanup action, the analysis for this sole purpose does not need to comply with MTCA cleanup regulations. However, cleanup actions at the tailings and waste rock piles will need to comply with MTCA because Ecology is independently exercising MTCA authority at the Site and because certain MTCA provisions are ARARs under CERCLA.

Unique comment(s) addressed:
URSC08-16

Comment and Response: 33-14

Comment:
A comment noted that Intalco's supplemental human health risk assessment for the tailings and waste rock piles (ERM and URS 2009, Appendix F) demonstrated that, although there are individual exceedances of cleanup criteria, under current and future site use conditions, if Alternative 13M were implemented there are would be no exceedances of MTCA health goals.

Response:
The Agencies' disagreed with a number of the assumptions, methods, and conclusions used in the supplemental risk assessment; these were documented in USFS (2010b). The Agencies' evaluation of baseline human health risks presented in the ROD compares the exposure point soil concentrations (not individual sample concentrations) to human health-based soil cleanup levels in accordance with WAC 173-340-740(7). The Agencies' evaluation concluded that soil at the Honeymoon Heights Waste Rock Piles and DSHH; the Lower West Area including the Lagoon; and the Maintenance Yard exceed soil cleanup levels for protection of human health for direct contact with and/or ingestion of arsenic, cadmium, copper, lead, zinc, and/or gasoline-, diesel-, or heavy oil-range petroleum hydrocarbons. Therefore, the Agencies evaluated cleanup alternatives (including Alternative 13M) to determine which alternative would best eliminate risks at the Site, including the risks from contaminated soils in the areas noted.

Unique comment(s) addressed:
MWHA01-04

Comment and Response: 33-15

Comment:
Groundwater will never be a drinking water source within Tailings Pile 3, and only intermittent exceedances of aluminum occur immediately adjacent to Tailings Pile 3. Therefore, exceedance of soil criteria protective of groundwater is not a concern. Also, there are no human health issues concerns associated with direct contact with tailings or waste rock.

Response:
Under CERCLA, MCLs are ARARs and must be met in groundwater throughout the Site, unless there is containment at the WMA boundaries. The DFFS (URS 2004) determined the impracticability of cleaning up groundwater below the tailings piles. Without containment, there can be no WMA and MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3, or there would need to be an ARAR waiver for MCLs based on technical impracticability from an engineering perspective, which, if justified, would require a ROD Amendment.

Intalco has not demonstrated that its recommended cover for the tailings and waste rock piles satisfies ARARs for protection of human health.

The statement that there are no health concerns is apparently based on results of Intalco's supplemental risk assessment for the tailings and waste rock piles (ERM and URS 2009). Although Intalco's Draft Supplemental Human Health Evaluation for Tailings and Waste Rock Piles considered risks to specific receptors (recreational and occupational users of the sites) under a specific remedial alternative (13M), it was not a determination of a cleanup action. Table 10 of the ROD shows that there is human health risk from direct contact and ingestion of soil from lead at the Honeymoon Heights Waste Rock Piles; arsenic at the areas downslope from the Honeymoon Heights Waste Rock Piles; arsenic, cadmium, copper, and lead at the Lower West Area; cadmium, copper, lead, and zinc at the Lagoon; and arsenic, copper, lead, and petroleum hydrocarbons at the Maintenance Yard. Cleanup actions at the tailings and waste rock piles will need to comply with MTCA and CERCLA.

Unique comment(s) addressed:
ERMW07-04, ERMW07-26

Comment and Response: 33-16

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and asserted that a "handful" of exceedances do not equate to the exceedance of health goals under specific site use conditions. The comment said risk is not determined by a single location, especially for soil. Intalco's supplemental health evaluation for the tailings and waste rock piles used conservative remediation levels based on current and future site use which were not exceeded.

Response:
The Agencies agree that that human exposures to chemicals in soil should not necessarily be characterized using a single sample location. Consistent with MTCA, the Proposed Plan (Table 10) applied statistical methods using available soil data to estimate reasonable maximum exposure point concentrations for the Site areas.

Unique comment(s) addressed:
MWHA01-06

Comment and Response: 33-18

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and opined that the Agencies concurred with evaluating tailings based on soil samples from the top 6 inches for in the draft RI report. The comment noted that the Agencies later expressed concern about human exposures to deeper soil in the SFS when it became evident that significant tailings excavations would need to be made in order to achieve stable slopes to satisfy ARARs. Intalco's subsequent supplemental risk assessment for the tailings and waste rock piles evaluated health risks to soils to a depth of 15 feet and concluded health risks met MTCA goals.

Response:
The Agencies requested that Intalco further evaluate the risk from tailings and waste rock deeper than 6 inches when it became apparent that the remedy would involve regrading the tailings piles. It is necessary to consider the risk from tailings and waste rock that will be exposed during remediation.

There is no question that during remedial construction, humans could be exposed to deeper soil than has been characterized, which may have higher chemical concentrations then those detected in surface soils. Although the Agencies appreciate Intalco's inclusion of those data into the supplemental risk assessment for the tailings and waste rock piles, Intalco's Draft Supplemental Human Health Evaluation for Tailings and Waste Rock Piles considered risks to specific receptors (recreational and occupational users of the Sites) under a specific remedial alternative (13M); it was not a determination of whether a cleanup action is needed.

Unique comment(s) addressed:
MWHA01-03

Comment and Response: 33-19 and 33-20

Comment:
Soil samples collected from the top 2 feet of the tailings and waste rock piles are suitable for estimating maintenance worker exposures as described in Intalco's supplemental human health evaluation. Exposure parameter values used for the maintenance worker scenario are conservative and result in remedial levels that are an order of magnitude greater than the reasonable maximum exposure point concentrations. The comment asserts that soil samples collected from the upper 16 feet of the tailings piles are representative of conditions throughout the entire piles using site-specific and published information from other sites.

The comment referred to a previous memorandum that discussed perched zones of groundwater with elevated metals concentrations in aqueous phase at the base of the tailings, and asserted that these data demonstrate that no concentration enrichment of deeper soils would occur.

Response:
The exposure parameters referred to in the comments are a Remediation Level (RL) estimated by Intalco, and not a cleanup level. Remediation levels are defined as the particular concentration of a hazardous substance in any media, above which a particular cleanup action component will be required as part of a cleanup action at the Site, see WAC 173-340-200. Regrading the tailings and waste rock piles will result in potential human exposure to subsurface soils with hazardous substance concentrations higher than Intalco evaluated. Intalco's supplemental human health evaluation that was submitted along with the Alternative 13M report shows that within the depth of available samples, subsurface soil contain up to eight times higher concentrations of hazardous substances than does surface soil. Intalco's analysis is not necessarily protective since it is based on samples from within about 16 feet of the top of the tailings piles.

The final Feasibility Study includes an analysis (Appendix E of the DFFS, URS 2004) that indicates the concentration of hazardous substances increases with depth in the tailings piles. Workers will be exposed to these deeper tailings during regrading as part of the selected remedy, and maintenance workers may also be subsequently exposed to these deeper tailings as needed to repair erosion damage or for other reasons.

The Agencies accept the validity of the chemical analyses presented in the case studies as part of the comments, but not the comment writer's assertion that Intalco's studies document these processes in the Holden tailings piles demonstrate that concentrations at depth are below the remediation levels presented by Intalco's consultant.

Regardless of the whether the RL used in alternative exposure scenarios presented in Intalco's Draft Supplemental Human Health Evaluation for Tailings and Waste Rock Piles is protective, MTCA Method B methods for unrestricted land use must be used to calculate modified cleanup levels for the reasonable maximum exposure scenario. Method B is appropriate for selection of permanent cleanup levels, since the Site does not meet the criteria for Methods A and C under MTCA, see WAC 173-340-704(1), WAC 173-340-705(1), and WAC 173-340-706(1).

Unique comment(s) addressed:
URSC08-08, URSC08-03

Comment and Response: 33-21 and 33-22

Comment:
Intalco's risk assessments demonstrate that the Holden Mine Site does not pose a risk to human health. The Agencies' human health risk assessment presented in the Proposed Plan is based on unlikely, implausible, and/or hypothetical exposures. Human health risk is not in excess of target health goals identified by Intalco for recreational and occupational exposure at the tailings and waste rock piles.

Response:
Intalco's "Supplemental Human Health Risk Assessment" that was presented as part of the Alternative 13M report only addressed certain receptors, namely recreational visitors and construction workers in specific areas of the Site. This evaluation addressed Remediation Levels for particular cleanup scenarios, but did not address other areas of the Site or evaluate other potential pathways and receptors such as drinking water and residential exposure. Intalco's analysis did not address the need for cleanup levels in accordance with MTCA Method B.

The final Feasibility Study shows that groundwater at the Site contains hazardous substance concentrations that exceed drinking water standards for aluminum, cadmium, copper, lead, and zinc. The final Feasibility Study also shows that some soil at the Site contains hazardous substance concentrations that exceed cleanup levels for protection of human health for direct contact for arsenic, cadmium, copper, lead, zinc, gasoline- and diesel-range hydrocarbons, and heavy oil-range hydrocarbons.

Tables in the ROD present reasonable maximum exposure point concentrations (RMEs) for chemicals in groundwater and soil and show RMEs that exceed chemical-specific ARARs. ARARs for groundwater include state and federal maximum contaminant levels (MCLs) and MTCA Method A and C groundwater levels protective of humans drinking groundwater. Soil ARARs protective of human health include MTCA Method A and B soil levels for unrestricted land use.

Many of these ARARs are risk-based and the intent of the data tabulated in the Proposed Plan is to show the areas and chemicals that require action to be protective of human health. ARARs that pertain to unrestricted land use are applicable because current and future land use at the Site is not industrial. Compliance with ARARs is a requirement under MTCA and CERCLA.

Unique comment(s) addressed:
MWHA01-01, MWHA01-02, MWHA01-07, ERMW07-09

Comment and Response: 34-1

Comment:
The commenter reiterates that Intalco's loading analysis is concentration based, as presented in the Draft Hydrogeology Technical Memorandum Addendum in the context of the Contingent Remedy, dated 2/24/10.

Response:
The Agencies understand Intalco's statement that its calculated load is based on concentration times flow. However, the concentration calculated in the presented loading analysis assumes a mixed condition at the base of the stream channel where the Railroad Creek samples were collected. The loading analysis does not reflect the concentration before the point where groundwater enters the hyporheic zone, which is the point of compliance for surface water for the Selected Remedy under CERCLA and MTCA [see WAC 173-340-730(8)(d)(i)].

Unique comment(s) addressed:
URSC07-52

Comment and Response: 34-2

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and explained Intalco's conceptual site model considered that impacted groundwater discharges to Railroad Creek in the area of monitoring point SG-10. Tenmile Creek is a losing Creek and thus a hydraulic barrier for impacted groundwater migrating further downstream.

Response:
There are not sufficient data to fully support Intalco's conceptual site model and conclusions.

The well cluster at DS-9 suggests both upward and downward vertical gradients in the area of SG-10. Planned baseline monitoring includes an analysis of gaining and losing conditions along the stream in concert with chemical testing at the groundwater-surface water interface. With this additional data, the Agencies and Intalco should have a better understanding of where contaminated water discharges into Railroad Creek. The Agencies do not accept Intalco's assertion that Tenmile Creek is a hydraulic barrier to prevent impacted groundwater migrating further downstream.

Unique comment(s) addressed:
URSC07-37, URSC07-38, URSC07-53

Comment and Response: 34-3

Comment:
The comment states that the full extent of groundwater dynamics may not be documented at the Site. Folding and/or striking geological stratification with associated fractures can also be a consideration in potential for groundwater movement and contaminant migration.

Response:
The Agencies agree that the structural geology of the Railroad Creek valley is complex. Intalco has done much work to characterize the hydrogeological environment, and the Selected Remedy provides for protection of both groundwater and surface water.

Unique comment(s) addressed:
NPEC01-05

Comment and Response: 36-1, 36-8 and 38-15

Comment:
The Agencies significantly understate the adverse impacts to Holden Village and the environment.

Alternative 13M carries the same short-term risks to community, but Alternative 14 carries higher risk levels for a longer time (2-3 years for Phase 1 and 1 to 2 years for Phase 2) with no risk reduction to human or ecological receptors.

Alternative 14 could require additional borrow sources. The Agencies should evaluate and select the components that best benefits human health and the environment on the whole. For example, building the Phase 2 barrier wall or installing a 2-foot thick cap on the tailings and waste rock piles (as opposed to a 1-foot thick cap) have significant negative environmental impacts.

Alternative 14 will result in more emissions and environmental risk to generate and transport additional materials. Adverse impacts to Holden Village and the environment include: road traffic, fuel spills, barge traffic, air quality (dust and emissions), noise, shutdown of operations/facilities, visual impacts, recreation impacts, and availability of local resources/services (e.g., ferry, barge, hotels).

The Agencies should reconsider remedy components in light of State of Washington Executive Orders promoting sustainable practices and reducing greenhouse gas emission considering negligible risk reduction. Agencies should look for opportunities to avoid incurring adverse impacts on Holden Village and the environment.

Alternative 14 could require additional borrow sources and result in more emissions and environmental risk to generate and transport additional materials. Intalco estimates that, compared with Alternative 13M, Alternative 14 would require 141,000 additional cubic yards of material for the tailings and waste rock cover and 43 more days to implement, which could push the schedule to a third construction season. The Phase 2 barrier wall would add 3,334 feet to the length of the wall and 116 additional days of construction.

Response:
The final Feasibility Study assessed the long-term versus the short-term impacts of each alternative, including consideration of potential impacts on Holden Village and the environment. The Selected Remedy satisfies the threshold requirements under CERCLA and MTCA for a final remedy, but Alternative 13M does not.

Alternative 13M does not satisfy the threshold requirements, thus it is moot that its potential to adversely impact the environment is less than an alternative that does satisfy the threshold requirements and can be implemented in a way that controls negative impacts on the environment. The Selected Remedy is more protective of human health and the environment than is Alternative 13M, as discussed in the final Feasibility Study.

The following addresses specific comments on Alternative 14, which is the basis for the Selected Remedy:

- While it is true that construction of the second phase barrier wall or a tailings and waste rock pile cover that satisfies ARARs will use more resources than would alternatives that are not protective, the net result is a benefit to the environment.

- Although the Selected Remedy will take longer than other alternatives to implement, the Agencies decided to implement the Selected Remedy in phases to reduce its potential adverse impacts on Holden Village.

- The Selected Remedy may require additional quarry and borrow materials compared to Alternative 13M (pending remedial design of the tailings and waste rock pile caps). The Selected Remedy may also involve a greater amount of fuel consumption and emissions compared to other alternatives that will not achieve as much cleanup or satisfy ARARs.

- Potential adverse impacts of implementing the Selected Remedy, including road traffic, risk of fuel spills, barge traffic, air quality (dust and emissions), noise, shutdown of operations/facilities, visual impacts, recreation impacts, and impacts on availability of local resources and services can and will be mitigated by management practices during remedial construction. The Selected Remedy will be more protective and more sustainable than other alternatives that do not fully clean up the Site (e.g., Alternative 13M), or which would accomplish cleanup with larger potential adverse impacts (e.g., Alternative 11M).

The Agencies have concluded that the benefits to human health and the environment of the Selected Remedy outweigh the potential adverse environmental impacts to a greater degree than other alternatives.

Unique comment(s) addressed:
MWHA01-58, MWHA01-57/58, INTA01-71, MWHA01-25, KBLO01-02, BOLS01-02, INTA01-66
MWHA01-25, KBLO01-02

Comment and Response: 36-2 and 36-3

Comment:
The commenter supports Alternative 14 because it minimizes the environmental impact of the remediation itself.

Another commenter stated that it's important that remediation be low impact, and said Alternative 14 is important since it puts off more intrusive measures that may not be necessary. The public will not want to see an eyesore in a wilderness area.

A third commenter wishes that the remedy preserve the valley with as little disruption as possible to its ecology.

Response:
Comments noted, thank you for your comments.

Unique comment(s) addressed:
HBMC01-03, TPER02-02, GMAT01-02

Comment and Response: 36-6, 36-7 and 38-5

Comment:
One commenter expressed concern that all environmental impacts are taken into account and represented in the final plan and hopes that the environmental impacts of the work being done and the future operation are kept to the lowest impact necessary for an effective cleanup.

Another commenter noted that Holden Village has some concern for the environmental impacts of solutions: e.g., extensive fuel hauling, diesel plant noise, quarrying rock at scenic locations near Holden Village, etc. The comment (which was originally submitted in a letter to the Forest Service in 2002 and was resubmitted as part of Holden Village's comments on the Proposed Plan) said "We expect to have an active voice in the balancing of environmental benefits and harms you must undertake in the cleanup decision-making process, and we will need to have clear and concise explanations of all the consequences to the Village of the various cleanup operations".

Response:
Thank your for your comments. The Proposed Plan and the ROD discuss whether each alternative addresses the CERCLA and MTCA threshold requirements for a final remedy, and compare the environmental impacts of alternatives that do meet the threshold requirements as required under CERCLA and MTCA.

The Agencies have taken steps to assure that they consider the well-being of Holden Village, and that through review, input, and approval of remedial design, the Agencies are prepared to assist Holden Village to mitigate impacts of construction. The Agencies have taken into account Holden Village's request for a five-year gap between the conclusion of the first phase of construction and the initiation of the second phase, which is part of the Selected Remedy. The Agencies will continue to inform Holden Village and consider their comments and concerns during remedy design and implementation.

Unique comment(s) addressed:
CCAR01-04, HVWC09-09

<u>Comment and Response: 37-1</u>

Comment:
One comment inquired whether institutional controls referred to in the Proposed Plan indicate the public may not be able to use old trails after the restructuring of the tailings piles.

Response:
The potential effect of the remedy on the Holden area trail system and the need for any changes in the trail system will be evaluated during and after construction. The Agencies are committed to maintaining the value of the Holden area environment, including recreational hiking trails, consistent with necessary limitations resulting from the remedy. The Forest Service intends to re-establish existing trails to the degree possible, which may involve rerouting portions of some trails. The remedy includes institutional controls, likely including signage, along the Honeymoon Heights trail (which is mostly on lands owned by Holden Village) to limit human exposure to contaminated materials.

Unique comment(s) addressed:
CPQA01-04

<u>Comment and Response: 37-2</u>

Comment:
There should be no borrow pits on the north side of the road between the Village and Monkey Bear Falls. These are popular hikes for senior and handicapped hikers.

Response:
Comment noted. The determination of where to locate quarries and borrow pits will include consideration of potential visitors and residents.

Unique comment(s) addressed:
HBMC02-04

<u>Comment and Response: 37-3</u>

Comment:
Hope excavation being done has the visual impact in mind so it allows this wound to heal and eventually fade into the landscape.

Response:
Planning and implementation of the remedy will consider visual impacts as required in the Forest Plan and other ARARs that are identified in the ROD. The slopes of the tailings and waste rock piles will be regraded to improve stability, capped, and revegetated to present a more natural appearance. The new Railroad Creek channel will also appear more like a natural stream channel than the current relatively straight channel excavated by the Howe Sound Company during mining.

Unique comment(s) addressed:
CCAR01-07

Comment and Response: 37-4

Comment:
Revegetation takes time, so I wonder what the scar is going to be in the meantime, what it is going to look like and to make sure that is considered - the impact on the appearance of what I consider the gateway to a national treasure.

Response:
Remedial construction will include temporary erosion control for all disturbed areas, which will then be restored to self-sustaining native vegetation as soon as possible. Revegetation will likely be a mix of tree seedlings, shrubs, and wetland plants, to create diverse habitat similar to other areas of the Railroad Creek valley. One benefit of separating remedial construction into two phases will be to limit the extent of disturbed area at one time.

Unique comment(s) addressed:
PBAN01-01

Comment and Response: 37-5

Comment:
I worry about what this concrete wall is going to look like and whether it is going to look like another barrier along I-5 and whether we want that at the opening of a national treasure.

Response:
The groundwater barrier walls will be subsurface barriers such as would be constructed using the slurry trench method using a mixture of soil and bentonite (a low permeability clay material) or of soil, bentonite, and cement.

The groundwater barriers would not significantly change the visual character of the Railroad Creek valley because they would be constructed entirely below the ground surface.

Unique comment(s) addressed:
PBAN01-02

Comment and Response: 38-1, 38-10, 38-18, 38-21, 38-27 and 38-38

Comment:
Some comments inquired about whether Holden Village would close or be open to visitors during construction. Concern was expressed that construction will impact the Holden Village experience and the number of visitors to Holden Village. The comment asserted that the drop-off in the number of visitors from previous work did not recover until well after the work was complete. Holden Village depends on a continuous stream of visitors and volunteers, and cannot survive without them.

A related comment expressed hope that remediation work will not interfere with Holden Village's programs and asked that the Agencies try to limit disruption to Holden Village.

Another comment asked about the tasks required to setup the logistics and infrastructure to prepare for remedial construction, and for Holden Village to prepare to provide hospitality and serve the needs of the construction forces. Will the early actions essentially seem like preconstruction that is potentially disruptive to Holden Village?

Other comments expressed concern about whether the Holden school would be able to continue operations during construction. Also, how will remedial construction affect the Chelan School District's programming for outdoor education at Holden Village?

Response:
While the Agencies have not mandated that Holden Village suspend operations during remedial construction, the Agencies understand a large construction project does not lend itself to the usual expected Holden Village experience.

Holden Village must make its own independent determination of how to address the impacts of remedy construction with respect to visitors, programming (e.g., outdoor education), and operations. Through review, input, and approval of remedial design, the Agencies are prepared to assist Holden Village to reduce the adverse impacts of construction.

The Selected Remedy will be implemented in phases as discussed in the ROD, to reduce the potential adverse impacts of construction on Holden Village.

Construction will largely be limited to the late spring through early fall, when the area is free of snow. While it is unclear whether Holden Village will have residents with school age children during construction, the Agencies do not see any reason why Holden School would be unable to remain open and operate during periods when construction overlaps with the school year.

Intalco will develop construction plans, including preconstruction activities and a schedule during Remedial Design, that include consideration of logistics and infrastructure needs. The extent of early actions and the potential impacts on Holden Village prior to heavy construction are currently unknown. The Agencies will continue to work with Holden Village and Intalco to keep Holden Village informed of remedial design and construction planning developments as details become available.

Unique comment(s) addressed:
JBAN01-01, CPQA01-03, WPQA01-12, JPIE01-01, PHIN01-01, HVWC05-05, PFRE01-01

Comment and Response: 38-2

Comment:
Commenters inquired the following regarding potential health and safety issues for Holden Village:

-What health hazards will exist for people in Holden Village during construction, specifically regarding dust and air quality? Has this been evaluated?

-What will be done to ensure no hazardous materials will blow into Holden Village during and after construction?

-What are plans to monitor air quality during construction and provide this information to those in Holden Village?

Response:
Potential health hazards associated with implementation of the remedy were evaluated as part of the CERCLA and MTCA criteria for remedy selection, see Section 10.1.2 of the ROD, and related sections of several documents that comprise the final Feasibility Study (e.g., the DFFS, SFS, and ASFS). This evaluation included short-term risks that might be posed to the community as well as potential impacts to workers and the effectiveness and reliability of protective measures.

Short-term risks are associated with increased traffic on the Lucerne Holden Road and around the Site, as well as construction. Before construction Intalco will be required to prepare a Health and Safety Plan that will address hazards related to remedy construction, including air quality and air quality monitoring, subject to the Agencies' review and approval.

Under existing laws, the construction contractor will be required to implement best management practices to control dust generation and ensure that air quality is not hazardous. Plans for disseminating air quality information to people in Holden Village will also be determined during design and construction planning.

The Selected Remedy includes capping exposed tailings, capping or treating impacted soil, and institutional controls, that in combination would be protective of human health.

Unique comment(s) addressed:
HPQA01-02, RBRI01-01, WPQA01-13

Comment and Response: 38-3

Comment:
What will be done to ensure that all exposed dirt in Holden Village is treated, removed, or encapsulated to reduce or prevent further dispersion of hazardous materials?

Response:
As shown in Table 10 of the ROD, the concentrations of hazardous substances in soil in Holden Village do not exceed criteria based on protection of human health. However, as an exception to this statement, it is believed that tailings may have been used for pipe bedding for some of Holden's underground water or sewer pipelines, and that these tailings could be encountered during future excavations for maintenance. These tailings may pose a risk to human health and the environment if exposed in future maintenance excavations. However, the tailings are not currently exposed and, therefore, do not pose a risk to human health in their current setting. Therefore, removal is not warranted until the time that utility work is conducted. The Selected Remedy includes establishment of Institutional Controls that will, among other things, include Holden Village having a plan to safely manage tailings that may be encountered in the future

Unique comment(s) addressed:
RBRI01-02

Comment and Response: 38-4 and 38-30

Comment:

Several comments expressed support for Alternative 14 based on its approach to minimizing the impacts on Holden Village and the Agencies' interest in allowing Holden Village to thrive into the future. Some of these comments also noted that the Proposed Plan considered long-term viability of Holden Village and that the phase construction approach would benefit the Village. Long-term success of remediation is tied to the long-term health of Holden Village.

Response:

Comments noted. Thank you.

Unique comment(s) addressed:

CKER01-02, DGWI01-03, DJOH01-02, HBMC01-02, JSTA01-03, NMAT01-02, PFEN01-02, SKRA01-03, THBR01-02, RDUN01-01

Comment and Response: 38-6

Comment:

Several commenters expressed the need for people to be able to get in and out of Holden Village, and that the dock needs to be accessible during dock work.

Response:

Intalco will work with the Agencies and Holden Village to manage potential construction impacts to Holden Village, so that the Village will remain accessible leading up to, during, and following major construction. This includes road improvements and managing construction traffic on the Lucerne Holden road, a new bridge over Railroad Creek to divert most construction traffic around the Village, and upgrades to the dock and barge ramp at Lucerne.

Unique comment(s) addressed:

HVWC09-03, RGID01-06

Comment and Response: 38-7

Comment

Respect and cooperation with Holden Village is a vital factor in selecting contractors to perform the work.

Response:

Intalco will hire the remedial construction contractors and oversee their work, and the Agencies have noted that Intalco has expressed a willingness to work with Holden Village to manage potential construction impacts. The Agencies will also assist Holden Village to reduce impacts of construction through review and approval of remedial design and construction plans.

Unique comment(s) addressed:

HVWC09-07

Comment and Response: 38-8

Comment:

Several comments expressed concerns regarding the impacts of the remediation on Holden Village infrastructure including:

-Water system (e.g., potential damage to buried water lines)

-Portal Museum and Maintenance Shop reconstruction after remediation

-Need for assistance in upgrading Holden Village's infrastructure due to increased demands during construction and long-term (e.g., power requirements)

-Ability to maintain and operate infrastructure with minimal interruptions

-Potential impacts of Railroad Creek relocation on Holden Village buildings

Response:

Potential impacts to Holden Village infrastructure and needed protective measures will be addressed by Intalco during Remedial Design and construction planning. The Agencies will work with Intalco and Holden Village to address potential interruptions to infrastructure usage and prevent damage to Holden Village infrastructure.

The Selected Remedy includes infrastructure improvements to support the remedy, which will also provide some long-term benefit to Holden Village.

The Agencies expect details of measures such as relocation or protection of Holden's facilities such as the Maintenance Shop and Portal Museum will be worked out cooperatively during Remedial Design.

Unique comment(s) addressed:

AMAN01-01, DHEA01-01, HBMC02-08, HVWC09-04, WPQA01-02

Comment and Response: 38-9 and 38-16

Comment:

The Proposed Plan calls for institutional controls that would apply to Holden Village property and would require "future remediation prior to changes in land use." Holden Village is unaware of any current or reasonably anticipated future land use that would require further remediation on Holden Village property beyond that called for in the Proposed Plan. Holden Village plans to record a standard MTCA restrictive covenant for capped areas and other locations where contamination will be contained. Holden Village recognizes existing contamination in certain areas will need to be accounted for in future development on much of Holden Village's property; however, changes in land use may not require additional remediation, depending on the use involved.

Another comment noted concern about what Holden Village will have to do for soil investigations for future excavations in Holden Village, for example if a pipe breaks.

Response:
The Institutional Controls for Holden Village property would primarily be focused on assuring access to maintain and monitor the remedy, and to prevent certain changes in land use (e.g., excavation or grading that would result in drainage changes that might cause the spread of contamination), as well as reasonable measures to address contaminated materials that may be encountered during future excavations (e.g., for maintenance of sewer or water pipelines). The Agencies have already initiated discussion with Holden Village about how to handle tailings or other hazardous substances if they are encountered during excavations in the Village

In some areas of the Site (e.g., the LWA), future land use changes such as logging may result in an opportunity to accomplish remediation that is more invasive, but potentially more effective, than remediation measures that are part of the Selected Remedy.

Unique comment(s) addressed:
HVWC01-05, AMAN01-02

Comment and Response: 38-11

Comment:
One comment writer expresses concern about long-term staffing needs for operation and maintenance of each remedy, and was very concerned with the possibility of multiple full time staff being needed to operate a sophisticated treatment plant. Holden Village would have to make significant accommodations to make room for a large (more than 2) permanent staff that might be required to keep a complicated treatment plant continuously in operation.

Response:
Intalco is likely to manage the long-term remedy operations and maintenance, including providing staff needed and accommodations for these staff. While it is possible that Intalco will want to work with Holden Village to provide accommodations for operations and maintenance staff, there are other alternatives that could be considered.

The number of maintenance and operations staff, either full-time or part-time needed for specific parts of the remedy will be determined during Remedial Design.

Unique comment(s) addressed:
HVWC08-04

Comment and Response: 38-12

Comment:
One comment expressed concern that the elimination of green space between Holden Village and the tailings would have a long-term negative impact. The comment said the commenter was pleased to see the Agencies' new proposed alternative did not include significant creek relocation.

Response:
This comment was originally submitted in a letter to the USDA Forest Service in 2004 and was resubmitted as part of Holden Village's comments on the Proposed Plan in 2010. (Holden Village said the resubmittal was intended to ensure the record reflects the full set of written comments

submitted by Holden Village throughout the Feasibility Study process). The comment refers to a remedial alternative that is no longer being considered and was not evaluated in the Proposed Plan.

The Selected Remedy includes relocation of a portion of Railroad Creek adjacent to Holden Village. The extent of Railroad Creek relocation will be determined during Remedial Design. The regraded tailings pile slopes will be capped with clean soil and revegetated, and the area disturbed by construction on each side of the creek channel will be restored to provide riparian forest habitat. Over time the Agencies expect this will mitigate adverse visual impacts when viewed from Holden Village.

Unique comment(s) addressed:
HVWC08-06

Comment and Response: 38-13

Comment:
Holden Village will have a difficult time carrying out its mission if a major non-hydroelectric facility must be located near Holden Village and kept continuously supplied with large volumes of fuel over the course of decades, if not centuries.

Response:
The Selected Remedy includes the Agencies' stated preference for hydroelectric power. The development of new hydroelectric power sources and/or improvement of the existing Holden Village system, and possible alternatives, will be evaluated during Remedial Design.

Unique comment(s) addressed:
HVWC08-07

Comment and Response: 38-14 and 38-29

Comment:
The Proposed Plan says little about the impact on Holden Village, only stating that community acceptance will be evaluated in the ROD following receipt of public comments. Holden Village has repeatedly expressed its objections to Alternatives 11 and 14 and support for Alternative 13M.

Response:
The Agencies note that this is Intalco's comment regarding Intalco's perception of Holden Village's position. The ROD describes anticipated impacts and mitigation of adverse impacts on Holden Village during implementation of the Selected Remedy. Holden Village has provided comments on the Proposed Plan, which the Agencies have addressed. Throughout design and implementation of the Selected Remedy, the Agencies will continue to consult with Holden Village and consider its input in developing plans that reduce potential adverse impacts on the Village and its operations.

Unique comment(s) addressed:
INTA01-70

Comment and Response: 38-17

Comment:

One comment noted that while costs may be minimized by locating quarries and other remedy support infrastructure near Holden Village, placing these further down valley will make for a cleaner environment and maintain the wilderness experience of Holden Village.

Response:

Quarry and borrow area sites will be evaluated during Remedial Design. Selection criteria to be weighed include quality and quantity of material available at various sites, location relative to existing resources, including Roadless areas and Holden Village, traffic impacts on the Lucerne Holden Road, and a number of other factors, not just costs.

Unique comment(s) addressed:

JMAT01-08

Comment and Response: 38-19, 38-32, 38-35 and 38-37

Comment:

One comment expressed concern that there would be an adverse financial impact to Holden Village because it will have ongoing expenses without its necessary income stream from guests if the Village closes for two years during heavy construction. The comment asserted that Holden Village cannot experience significant financial disruption due to the cleanup or it may not remain viable. Operational interruptions, both in facilities and volunteer staffing, will have financial consequences for Holden Village's ability to carry out its mission.

A related comment suggested that Holden Village could generate income during construction if remediation workers could be housed in the Village, avoiding development of new housing and mess hall at taxpayers' expense.

The comment noted that any remedy that requires Holden Village to cease operations and shut down for any significant length of time would threaten the long-term viability of Holden Village. The comment said that Holden Village may be able to accommodate a brief hiatus, but not a significant closure.

Response:

Holden Village must make its own independent determination of how to address the impacts of remedy construction with respect to visitors, programming, and operations.

Intalco has indicated a willingness to do some work ahead of, or following, the period of major construction to reduce the duration of heavy construction and potential impacts on the Village. The Agencies understand that Holden Village is considering a two-year shutdown for normal operations during the period of heavy construction.

The Agencies also understand that Holden Village on its own initiative may consider providing housing and meals for the remediation construction crews. It will be up to Holden Village and Intalco to negotiate the rates for such accommodations or to make other arrangements.

The Agencies expect Intalco to pay the costs of housing and meals for workers, as well as the other costs of remediation. Thus, the cost of the cleanup would not be at taxpayer's expense.

Unique comment(s) addressed:
LGOC01-02, HBMC02-06, HVWC08-05, HVWC09-05

Comment and Response: 38-20 and55-15

Comment:
Several comments requested that the scope and duration of the cleanup be balanced against the disruption that construction would cause to Holden Village and that the main construction period be limited to one or two years.

Response:
Comments noted. The Selected Remedy is based on the alternative that best protects human health and the environment, in accordance with both state and federal law. The potential adverse impacts on Holden Village were considered during the evaluation of alternatives leading up to remedy selection.

Unique comment(s) addressed:
LGSP01-03, PHIN01-05, CKAI01-05, JQUE01-03, LLAN01-01, MMAN01-02, RCTR01-03, AROG01-01, CGIE01-02, COOC01-02, CWAG01-03, DJOH02-02, DMES01-02, DMFA01-05, HBMC02-02, JMCQ01-02, KSAL01-03, LROE01-02, MLEE01-02, PAND01-02, PONE01-03, PTEL01-01, TWAG01-04

Comment and Response: 38-22

Comment:
What is 3 years post-construction monitoring? Does that mean there would be Intalco and Agency representatives in Holden Village continuously or would they come in and out?

Response:
Monitoring is common after completion of every environmental cleanup accomplished under CERCLA and MTCA, to assure that the remedy is effective and achieves its goal of protecting human health and the environment. Monitoring requires environmental professionals to visit Holden periodically (i.e., not continuously) following remedial construction. Because hazardous substances will be left on Site (e.g., the tailings and waste rock piles below protective caps, and contaminated groundwater contained within underground barrier walls), there will be a formal review of the monitoring results every five years for as long as maintenance of the remedy is needed.

The Agencies have decided to complete remedial construction in two phases, separated by a period of five years between periods of heavy construction, to reduce the adverse impacts of construction on Holden Village.

Intalco maintains that the second phase of the remedy may not be needed, although this assertion is not supported by existing information. The Selected Remedy allows Intalco to collect additional data by monitoring for a period of up to three years following completion of the first phase of the remedy. This period is limited to three years so that the new data may be evaluated in the fourth year to determine whether the second phase can be modified, or whether it is needed. Unless new information collected in the three years after the first phase clearly indicates cleanup goals will be met within a reasonable restoration time frame, the second phase of construction will be designed in the fifth year and implemented immediately thereafter.

At this time, Intalco has not presented any specific plans for monitoring during the three years following completion of the first phase, so it is not known whether there would be any need for workers to be continuously on site for monitoring. However, it is likely that post-construction monitoring would involve collection of groundwater and surface water samples from time to time, similar to the data collection accomplished for evaluation of cleanup alternatives.

In addition maintenance and operation of the groundwater treatment facility or other parts of the remedy will likely require other on-site workers, but there are currently no decisions as to where they would be housed, e.g. in Holden Village, or at Lucerne.

Unique comment(s) addressed:
SSTE01-02

Comment and Response: 38-23 and 55-13

Comment:
One commenter appreciated the concerns of Holden Village but did not believe it is at risk of losing its legacy or lifestyle. The comment asserted that Holden Village stands to benefit from doing the remediation right this time.

Another comment noted that the energy, love, and dedication demonstrated by the Holden Villagers is a clear indication they are in no danger of losing their legacy or lifestyle.

Response:
Thank you for providing your perspective. The Agencies believe it is appropriate to consider and mitigate the potential adverse impacts of implementing the remedy.

Unique comment(s) addressed:
TPHA01-02, AWER01-02

Comment and Response: 38-24, 38-25 and 38-28

Comment:
Several commenters expressed concerns regarding the noise levels (i.e., noise pollution) during construction (both peak levels and durations) and during long-term remediation operations (e.g., due to hydropower or diesel generators, treatment plants, traffic). Commenters indicate noise pollution is a more serious concern in a peaceful wilderness setting compared to an urban environment.

Holden Village prefers the least disruptive remedy that is protective of human health and the environment. Noise, dust, traffic, general safety, and facilities access are key issues for Holden Village, as well as fuel hauling and diesel generator operation (pollution and environmental risk of *spills) and rock quarry locations. Holden Village prefers to minimize the construction duration and scale in order to minimize impacts on Holden Village. The greatest expressed concern is impact of operations and maintenance fuel and lime consumption and staffing levels (e.g., there is concern that the groundwater collection trench will require significant maintenance particularly in winter and impact Holden Village life for a long time). Holden Village asks that the Agencies seriously weigh and factor the Holden Village's preferences and the impact on the local community in the decision-making process.*

Other commenters noted that noise, dust, traffic, and general safety issues will be important to discuss and manage. The commenters expressed concern about the quantity of truck and other vehicle traffic associated with each remedy, including access road traffic including both traffic through Holden Village and traffic in the vicinity of Holden Village. Concern was also expressed about fuel requirements for power plants and long-term impacts on traffic and safety.

Response:
The Agencies recognize that short-term impacts of remediation are not consistent with the environment that Holden Village typically operates in, and have taken steps to reduce the adverse impacts of remedial construction on the Village.

Intalco will perform construction planning as part of Remedial Design to determine the best means to mitigate adverse construction impacts, which will include an assessment of traffic issues and fuel requirements. Intalco will also develop a Health and Safety Plan that will address safety issues in relation to the public (e.g., Holden Village) and the construction workers. Intalco plans will need to include consideration and mitigation of noise, air pollution, and lighting and glare if after-dark construction is planned.

Over the long term, hydropower is expected to have less adverse impact on the Village compared to diesel generators. However, in addition to hydropower, both gasoline- and diesel-powered equipment will need to be used over time as part of operating and maintaining the remedy.

The Agencies are aware of the potential adverse impacts of noise pollution, and through oversight of Intalco's remedial construction and operations and maintenance, will continue to work with Intalco and Holden Village to mitigate these adverse impacts on village operations and other users of the National Forest.

Unique comment(s) addressed:
DMFA01-03, HVWC08-02, RBRI01-03, WPQA01-01, BOLS01-02, HVWC09-06, HVWC08-03, HVWC07-01, PWES01-01

Comment and Response: 38-33

Comment:
One comment expressed the opinion that a remedy that requires more than 1.5 seasons of heavy construction will threaten the future viability of Holden Village. The comment expressed concerns regarding lengthy construction time frames, a massive construction effort, and long-term energy requirements, and noted that these concerns have been expressed to the Agencies over a very long period of time. The comment asserted that Holden Village can survive heavy construction for 1

season or at most 1.5 seasons, but could not maintain normal programming if major construction continued over a 3- to 5-year period.

Response:
This comment was originally submitted in a letter to the USDA Forest Service in 2004 and was resubmitted as part of Holden Village's comments on the Proposed Plan in 2010. (Holden Village said the resubmittal was intended to ensure the record reflects the full set of written comments submitted by Holden Village throughout the Feasibility Study process). The comment refers to a remedial alternative (Alternative 11) that was modified and evaluated as Alternative 11M in the Proposed Plan.

The alternative referred to was not selected for implementation because the Selected Remedy better protects human health and the environment, as discussed in the Proposed Plan.

The Selected Remedy will be implemented in phases as discussed in the ROD, to reduce the potential adverse impacts of construction on Holden Village.

Unique comment(s) addressed:
HVWC05-02

Comment and Response: 38-34

Comment:
A healthy and viable Holden Village provides innumerable benefits to the Forest Service, public at large, and even the mine cleanup itself. The comment writer trusts that all parties share the goal of maintaining the viability and health of Holden Village, but is concerned that the remedy chosen might severely impede Holden Village operations and ultimately affect Holden Village's viability.

Continuity of operations is essential to Holden Village's viability. Operational interruptions, or constraints that would significantly limit our ability to operate during the summer months, would cut off those guest fees without commensurate reduction in the costs of keeping Holden Village staffed and operating.

Response:
This comment was originally submitted in a letter to the USDA Forest Service in 2005 and was resubmitted with Holden Village's comments on the Proposed Plan to ensure the record reflects the full set of written comments submitted by Holden Village throughout the Feasibility Study process. The comment refers to a remedial alternative that is no longer being considered and was not evaluated in the Proposed Plan.

The Agencies also understand that Holden Village on its own initiative may consider providing housing and meals for the remediation construction crews. The Agencies expect that Holden Village and Intalco will negotiate the rates for such accommodations or to make other arrangements.

The Selected Remedy will be implemented in phases as discussed in the ROD, to reduce the potential adverse impacts of construction on Holden Village.

Unique comment(s) addressed:
HVWC07-02

Comment and Response: 38-36

Comment:
The comment said Holden Village will experience some disruption to its routine but expected to continue to receive guests hospitably and maintain the unique character and programs that are cherished by our visitors and volunteers.

Response:
This comment was originally submitted in a letter to the Forest Service in 2002 and was resubmitted with Holden Village's comments on the Proposed Plan to ensure the record reflects the full set of written comments submitted by Holden Village throughout the Feasibility Study process.

While the Agencies have not mandated that Holden Village suspend operations during remedial construction, the Agencies understand a large construction project does not lend itself to the usual expected Holden Village experience, as noted in Section 10.2 of the Proposed Plan.

The Selected Remedy will be implemented in phases as discussed in the ROD, to reduce the potential adverse impacts of construction on Holden Village. Through review, input, and approval of remedial design, the Agencies are prepared to assist Holden Village to reduce impacts of construction.

Unique comment(s) addressed:
HVWC09-02

Comment and Response: 38-39

Comment:
One comment asked if all of Holden Village's infrastructure (maintenance garage, water treatment plant, and hydropower) would have to be moved to the other side of the creek.

Response:
The Selected Remedy does not require that particular Holden Village facilities be relocated; however, the impacts of the remediation on Holden Village's infrastructure will be evaluated during Remedial Design. Some facilities may need to be relocated; but where these facilities will be located and whether the relocation is permanent or temporary has not yet been determined.

Relocated facilities may be on Holden Village's private lands (patented mining claims) or National Forest System land (which may require modification of Holden Village's special use permit with the Forest Service).

Unique comment(s) addressed:
WPQA01-16

<u>Comment and Response: 39-2</u>

Comment:

Holden Village's concerns with the Phase 2 Tailings Piles 2 and 3 groundwater barrier relate primarily to the adverse environmental impact associated with construction of this barrier, additional long-term energy needs, and additional sludge generation. The construction of a barrier would entail significant adverse environmental consequences and disrupt Holden Village; the groundwater barrier downgradient of Tailings Piles 2 and 3 seems excessive and has greater environmental risk than benefit.

Installation of this groundwater barrier has environmental impacts of its own, which Holden Village does not want to see visited on the Railroad Creek Valley unless absolutely necessary to protect Railroad Creek. We need to think further about its impact on the environment.

Response:

The final Feasibility Study demonstrates that a groundwater barrier is needed downgradient of Tailings Piles 2 and 3 based on currently available information.

When construction of the Selected Remedy is completed, long-term operation of the groundwater treatment facility will require additional energy and chemicals for treatment, and will result in generation of additional sludge as a by-product of treatment, compared to alternatives that are less protective. The potential impacts of constructing the Selected Remedy were considered in the detailed analysis of alternatives presented in the ROD (see also the Addendum to the Supplemental Feasibility Study dated June 1, 2010 for additional information).

The Agencies have concluded that environmental benefits outweigh the potential adverse impacts of constructing the Selected Remedy. The Selected Remedy will be constructed in two phases to reduce the potential adverse impacts of construction on Holden Village.

Unique comment(s) addressed:

HVWC01-12, INTA01-18, TWAG02-04,

<u>Comment and Response: 39-4</u>

Comment:

The commenter asks that any serious discussion of imposing a massive barrier wall on the easternmost tailings be deferred. The barrier wall would change the nature of the valley and end the viability of Holden Village.

Response:

The Selected Remedy involves construction of the groundwater barrier in two phases specifically to reduce the impact of construction on Holden Village. A groundwater barrier downgradient of Tailings Piles 2 and 3 is necessary to contain contaminated groundwater within the WMA and to prevent the ongoing release of hazardous substances in groundwater that would otherwise continue to flow into the wetlands east of Tailings Pile 2 and into Railroad Creek.

The groundwater barriers would not significantly change the visual character of the Railroad Creek valley because they would be constructed entirely below the ground surface.

Unique comment(s) addressed:
CJNA01-04, INTA01-18, TWAG02-04

<u>Comment and Response: 40-1</u>

Comment:
I hope that the water treatment facility or facilities utilize the best technologies that reduce the footprint on the land and the amount of toxic sludge waste that is produced.

Response:
The Selected Remedy uses groundwater treatment that was shown to be suitable for conditions at the Site, as discussed in the DFFS (URS 2004) and Appendix F of the SFS (Forest Service 2007b). The sludge produced by treatment is a waste that must be disposed of in a suitable manner, but it is not expected to be toxic as indicated in the comment. Sludge characterization tests conducted at other mine sites indicated that sludge from the same type of treatment process that will be used at Holden, is chemically stable and that leachate produced from the sludge is alkaline with metals concentrations in the leachate typically below the level protective of groundwater at the Site. Intalco will evaluate treatment technologies and sludge management options, and sludge disposal will be accomplished in accordance with ARARs, under Agencies oversight.

Unique comment(s) addressed:
CCAR01-06

<u>Comment and Response: 41-1</u>

Comment:
The proposed plan does not explain why excavation, instead of in situ treatment, is proposed for the open portions of the Ballfield Area.

Response:
The final Feasibility Study provides an explanation of why a soil removal or capping remedy was selected for some areas while *in situ* soil treatment was selected for other areas, as summarized in Section 12.2.1 of the ROD. Excavation and removal of hot spot soil with hazardous substances is part of the Selected Remedy for the Ballfield Area, but *in situ* treatment would be preferred if the contamination extends into adjacent undisturbed areas along the wilderness area boundary.

Unique comment(s) addressed:
INTA01-39

<u>Comment and Response: 41-2 and 41.3</u>

Comment:
One commenter was intrigued by the application of lime to all these areas that have windblown tailings including Holden Village proper. How do you do this, and what is the residual effect relative to people moving through the area, things like that? So it is not a process that requires people to avoid the area for a month or something?

Another commenter noted that in situ soil treatment (an interim action under MTCA) will need ongoing monitoring to assure protectiveness, and that reapplication may be needed.

Response:
Methods for the *in situ* soil treatment will be identified based on treatability studies conducted during Remedial Design and post-implementation monitoring. Monitoring is an integral part of the remedy for the Holden Site. Long-term monitoring of all components of the remedy, including *in situ* soil treatment, will be conducted to assess remedy performance, ARAR compliance, and protectiveness.

The method(s) selected to implement the *in situ* treatment will minimize impacts to people using the Site. For areas in the Village it may be as simple as using a lawn spreader for addition of granulated limestone to grass and garden areas. Granulated limestone is a common method used to raise the pH of landscaped and agricultural soil, and is not toxic to people.

Unique comment(s) addressed:
CPQA01-02, NPEC01-07

Comment and Response: 41-4

Comment:
The Agencies have provided no evidence that in situ treatment would work and treatability studies are not warranted because there is no reason to believe that they would show that in situ treatment would be effective.

Response:
Appendix B of the ASFS (Forest Service 2010a) provides a review of published information on lime applications as an *in situ* soil treatment to reduce the bioavailability of metals at mine sites. This information includes peer-reviewed scientific papers, including field studies at other mine sites. While this review concluded that lime application is feasible and could mitigate ecological risk, treatability studies are included in the ROD to design the most appropriate treatment and confirm the implementation is protective of terrestrial receptors.

Unique comment(s) addressed:
INTA01-41

Comment and Response: 41-5

Comment:
Available data do not support the selection of in situ treatment for six areas (Windblown Tailings, Holden Village, Ballfield, Lower West Area – West, Honeymoon Heights, and Downslope of Honeymoon Heights) because of one or more of the following reasons: a) there are no potential risks to terrestrial biota, b) pH adjustment could increase metals solubility/ bioavailability, c) current soil pH levels are not significantly depressed, d) there could be unintended harmful effects on existing vegetation, and e) surface lime application would be difficult to implement.

Response:
The final Feasibility Study documents risks to terrestrial receptors in the areas noted in the comment as well as other areas, as indicated by Hazard Quotient (HQ) values greater than 1. The Agencies'

evaluation of ecological risks related to exposure to hazardous substances in soil is discussed in Appendix E of the ASFS and the applicability of *in situ* treatment of soil to address these risks as discussed in Appendix B of the ASFS The Agencies do not agree with the comment that there are no potential risks to terrestrial biota. The soils in Holden Village for example had HQ values greater than 1 for plants from aluminum and copper, soil invertebrates from copper and zinc, and wildlife from aluminum, Table 14 of the ASFS summarizes the results for all terrestrial receptors for all areas of interest, see Forest Service (2010a).

The Agencies understand that increasing soil pH could increase solubility of some hazardous substances, and that there could be unintended adverse effects on some receptors from increasing soil pH too much, which is why the Selected Remedy includes pilot tests as part of remedial design, as discussed in Section 12.1.1 of the ROD. The Agencies considered the potential difficulty of lime application during the Feasibility Study process and do not consider it to be impracticable.

Based on comments received on the Proposed Plan, the Agencies further considered ecological risks from exposure to soils in various areas; results are presented in Houkal and Dagel (2011). As a result, the ROD does not include a requirement for *in situ* soil treatment in the Wind-Blown Tailings or Ballfield Areas.

Unique comment(s) addressed:
ERMW01-01, ERMW01-02, ERMW03-24, MWHA01-36, INTA01-40, ERMW03-21

Comment and Response: 42-1

Comment:
The commenter requests that additional data collected in Spring 2010 be reviewed and considered in the context of the ongoing baseline and long-term compliance monitoring programs to determine what additional monitoring is needed to demonstrate effectiveness of Alternative 13M in protecting aquatic organisms.

Response:
The Agencies considered all available data and Intalco's interpretation of the data in selecting the remedy for the Site. Data that only became available after preparation of the Proposed Plan have also been reviewed and the Agencies will continue to review baseline monitoring and other data collected during and after implementation of the remedy. Information collected to date indicates that groundwater under Tailings Piles 2 and 3 contains contaminants of concern above MCLs and that groundwater discharging to surface water downstream of Tailings Piles 2 and 3 exceeds aquatic life protection levels.

Unique comment(s) addressed:
URSC05-03

Comment and Response: 42-2

Comment:
The commenter states that Intalco's loading analysis presented in the Draft Hydrogeology Technical Memorandum Addendum in the context of the Contingent Remedy, dated February 24, 2011,

shows compliance with Agencies' proposed cleanup levels at station RC-5, located upgradient of Tenmile Creek.

Response:
The underlying assumption of Intalco's use of the loading analysis to calculate the concentration is a fully mixed condition, which is not acceptable for the surface water point of compliance. Under both CERCLA and MTCA, the Selected Remedy must be protective of all receptors. Groundwater discharging to surface water, therefore, must meet surface water cleanup standards before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates to protect surface water beneficial uses in accordance with CERCLA. Concentrations that represent a fully mixed condition, as predicted by Intalco's loading analysis, are not relevant since they do not represent conditions at an allowable point of compliance under either CERCLA or MTCA.

In certain circumstances, MTCA allows the establishment of a conditional point of compliance that is as close to the contaminant source as practicable but not farther than "within the surface water as close as technically possible to the point or points where groundwater flows into the surface water" [WAC 173-340-720(8)(d)(i)]. Establishment of such a conditional point of compliance is subject to requirements that include, among other criteria: a) it is not practicable to meet the cleanup level within the groundwater before it enters surface water; b) groundwater discharges shall be provided with all known, available, and reasonable methods of treatment; and c) use of a mixing zone to demonstrate compliance with surface water cleanup levels is not allowed. At Holden, it is practicable to meet cleanup levels at a point within groundwater beyond the barrier walls of the Selected Remedy, prior to discharge to surface water. The installation of such barrier walls constitutes a known, available, and reasonable method of treatment. As such, the sample(s) collected at RC-5 represent a mixed condition within the surface water that is not representative of an allowable point of compliance under WAC 173-340-720(8)(d)(i).

Unique comment(s) addressed:
URSC07-57

Comment and Response: 42-3

Comment:
The commenter indicates that tables in the Draft Hydrogeology Technical Memorandum Addendum (ERM and URS 2009) in the Context of the Contingent Remedy, dated February 24, 2010 were updated to show the uncertainty in the gaining and losing measurements collected from the staff gage and well point pairs. Furthermore the comment asserts that measurement technique will be addressed as part of the baseline monitoring.

Response:
The Agencies appreciate the addition of the uncertainty values to the tables.

Unique comment(s) addressed:
URSC07-16, URSC07-54

Comment and Response: 42-4

Comment:

One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and noted that data were not available to illustrate the gaining or losing conditions between stations RC-10 and RC-3.

Response:

The losing and gaining conditions in Railroad Creek will be further studied by monitoring during Remedial Design.

Unique comment(s) addressed:

URSC07-34

Comment and Response: 42-5

Comment:

The Agencies have previously commented that Intalco may not rely on staff gage data collected on one side of the creek to draw conclusions as to whether the same gaining or losing conditions are present on the opposite bank or below the bottom of the creek bed.

Responding to that comment, Intalco stated that it would be difficult to install well point and staff gage pairs or other devices to measure the groundwater/ surface water relationship and quality on both sides of the creek downstream of Tailings Pile 3 because access to the south side of the creek is very limited and measurement devices may not be able to be installed safely or accessed during high flow. In addition, at many locations downstream of the Site, the southern bank of the creek consists of bedrock, which would preclude the installation of manually-driven well points.

Response:

The Agencies do not disagree with the expressed concerns about safety or access. However, there is safe access to the south bank by way of the bridges across Railroad Creek. It is not reasonable to assume that conditions observed on one bank of the creek are the same as on the opposite bank. Wellpoints located across the river from the mine workings may not reflect groundwater contaminant concentrations flowing from the source areas.

With respect to bedrock, the Agencies note that Intalco's consultants have opined that bedrock downgradient of Tailings Pile 3 has a significant impact on groundwater base flow, but this has never been demonstrated.

Unique comment(s) addressed:

URSC05-04

Comment and Response: 44-1

Comment:

One comment related to the Agencies' prior comments on Intalco's loading analysis presented with the Alternative 13M evaluation report. The commenter states that the loading analysis presented in Intalco's Draft Hydrogeology Technical Memorandum Addendum (HTMA), dated 2/24/10, is relevant for evaluating remedy effectiveness at the surface water point of compliance. The data *used in the loading analysis were collected in a manner similar to how surface water compliance data would be collected in the future.*

Response:
The comment refers to the point of compliance for surface water under MTCA which is the point or points where hazardous substances are released to the surface water [WAC 173-340-730(6)]. MTCA has additional requirements where the release is from contaminated groundwater flowing into surface water [WAC 173-340-720(8)]. Under both CERCLA and MTCA, at this Site groundwater discharging to surface water must meet surface water cleanup levels protective of aquatic life within groundwater before that portion of the hypoheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates, not after it has mixed and become diluted with surface water.

The comment referred to the surface water grab samples Intalco collected at the base of the Railroad Creek channel, which are not at the conditional point of compliance for groundwater under MTCA, as described in WAC 173-340-720(8)(d). Grab samples in the creek water column are diluted and do not represent the conditions that aquatic species that use the sediment are exposed to. As a result, Intalco's loading analysis, based in part on the samples referred to in the comment, is not an acceptable basis for comparison of alternatives, and was rejected by the Agencies as discussed in the final Feasibility Study.

Unique comment(s) addressed:
URSC07-24

<u>Comment and Response: 44-2, 44-3 and 44-7</u>

Comment:
One comment provided clarification of Intalco's loading analysis presented in the Draft Hydrogeology Technical Memorandum Addendum and how it differs from the analysis presented in the Draft Final Feasibility Study (URS 2004) – particularly relating to the use of unaccounted load and source depletion factors. The commenter believes that the loading analyses presented in the DFFS and Draft HTMA provide important and useful information and should be considered during remedy selection along with the more recent groundwater and COPC transport modeling developed for the Site.

A related comment states that the load reduction efficiency used in the loading analysis in the Draft HTMA (submitted as part of Intalco's evaluation of Alternative 13M), was estimated based on relative permeability of barrier wall and modeled flow to Tailings Pile 2 collection trench.

Response:
The Agencies appreciate the additional information and understand the differences in the two loading analyses presented by Intalco. However, Intalco's loading analyses are not an acceptable basis for comparison of alternatives as described below.

Reach "Copper Cr. to RC-7". The Agencies presented a detailed critique of the DFFS loading analysis in Appendix A of the SFS (Forest Service 2007b). The mass loading analysis presented in the HTMA is also flawed, as noted herein (see also Appendix A of the SFS). The loading analysis results shown in Table 4-4 and Appendix G of the HTMA do not reflect model results for loading from Tailings Pile 2. Figures E5-5 and E5-6 show simulated MODPATH particles being captured by the remedial components. During low-flow conditions, only 46% (6 of 13 particles) of seepage from Tailings Pile 2 was simulated as captured by remedial components. During high-flow conditions, only 61% (8 of 13 particles) of seepage from Tailings Pile 2 was simulated as captured by the remedial components.

Reach "RC-7 to RC-2" and Downstream. As any impacted groundwater discharged downgradient of RC-7 is not collected for treatment, the load reduction efficiency for reaches downstream of RC-7 should be 0%.

Agencies Recalculation of Total Reach "RC-4 to RC-2" (spring high-flow). For load reduction analysis (Table 4-2 and Table 4-3) during Spring high-flow conditions, the distance-weighted average load reduction efficiency (LRE) between RC-4 and RC-2 is 46% (see bold average below):

	LRE Distance in Feet
RC-4 to Copper Cr.	95% 1500
Copper Cr. to RC-7	61% 1100
RC-7 to RC-2	0% 2000
RC-4 to RC-2	**46%** 4600

Agencies Recalculation of Total Reach "RC-4 to RC-7" (fall low-flow). For load reduction analysis (Table 4-2 and Table 4-3) during Fall low-flow conditions, the distance-weighted average load reduction efficiency between RC-4 and RC-7 is 74% (see bold average below):

	LRE Distance in Feet
RC-4 to Copper Cr.	95% 1500
Copper Cr. to RC-7	46% 1100
RC-4 to RC-7	**74%** 2600

Compared to the Agencies LRE values of 46% and 74%, Intalco reported total LRE for the above creek segments for spring and fall as 61% and 46%, respectively. The Agencies' evaluation indicated that this overestimation of load reduction represents a significant flaw in Intalco's loading analysis, and do not accept that it can be used for remedy selection.

Unique comment(s) addressed:
URSC07-25, URSC07-26/27/28/31, ERMW03-14

Comment and Response: 44-4

Comment:
In the Draft Hydrogeology Technical Memorandum Addendum, dated 2/24/10, Figures 4-5a and 4-5b illustrate an increase in load between Railroad Creek stations RC-2 (near the east end of Tailings Pile 3) and RC-14 (downstream about 1.7 miles east of Tailings Pile 3). The commenter hypothesizes that this increase is in part due to naturally occurring background concentrations of the constituents of concern. The comment further states that an increase in load downstream of the mine is not necessarily an indication that the load is coming from mine-related sources.

Response:
The Agencies do not agree that the increases in metals load observed downgradient of the mine tailings are likely attributable to naturally occurring background concentrations; rather, the tailings piles and mine workings are an ongoing source of contaminants to Railroad Creek. Background conditions in Railroad Creek are represented by samples taken upstream from the mine. Although Intalco's loading analysis does account for background contributions, it does not provide a means of differentiating the various potential sources of loading to Railroad Creek, other than by comparing detected concentrations to sample locations downstream (or upstream) of potential sources. The Agencies accepted Intalco's reasonable hypothesis that the increases in load downstream of the mine are from contaminated groundwater discharging into Railroad Creek.

The Agencies have concluded that the primary source of hazardous substances to Railroad Creek is acid rock drainage from Holden Mine. While the comment conjectures there may be other background sources downstream of the mine (e.g., north or south of Railroad Creek), data collected from groundwater below the tailings piles and elsewhere within the mine area clearly indicates that drainage from the mine is the predominant source of hazardous substances to Railroad Creek. Intalco's particle tracking model indicates that groundwater originating from the tailings pile area flows northeast toward Railroad Creek and would continue to flow downstream within the alluvial channel or water column. In addition, fall 2010 temperature profiling data (streambed vs. surface water) and geochemical parameters (increased metals and sulfate, decreased pH) indicate the upwelling of groundwater into Railroad Creek at several locations between RC-2 and RC-14. Furthermore, surface water and groundwater monitoring data for metals concentrations indicate increased metals at sampling locations identified to be upwelling downstream of the tailings between SG-2 and SG-13 (0.9 mile east/downstream of TP-3).

Unique comment(s) addressed:
URSC07-29

Comment and Response: 44-5

Comment:

The commenter is responding to the Agencies prior comment on Intalco's evaluation of Alternative 13M on data that indicate shallow groundwater between stations RC-2 and RC-14 is impacted by upwelling contaminated groundwater.

The commenter reiterates Intalco's prior assertion that the loading analysis in the Draft HTM indicates a high probability that compliance with surface water quality standards would be achieved downgradient of Tailings Pile 3 under Alternative 13M.

The comment also states that field parameters and sulfate data collected at points downstream of Tenmile Creek do not support the Agencies' interpretation that shallow groundwater between stations RC-2 and RC-14 is impacted by upwelling contaminated groundwater.

Response:

The Agencies have identified significant flaws in Intalco's Draft HTM loading analysis that invalidate its use to compare remedial alternatives or predict post-remedy conditions in Railroad Creek.

Data collected by Intalco from paired staff gages and well points downstream of Tailings Pile 3 show water quality in Railroad Creek is adversely impacted by groundwater base flow into the creek between stations RC-2 and RC-14. Gaining conditions have been measured at several stations between RC-2 and RC-14 (refer to Figure 9 of the ROD). Elevated concentrations of hazardous substances have been measured in shallow groundwater downstream of Tailings Pile 3, particularly at stations SG-9-WP through SG-12-WP, indicating that contaminated groundwater is upwelling into the creek. Field parameters, such as temperature differences, reduced pH, and higher specific conductance that would indicate contaminated groundwater, are also reported at these stations. The Selected Remedy will contain groundwater above cleanup levels and prevent it from discharging into Railroad Creek in this area, whereas Intalco's proposed Alternative 13M would not.

Unique comment(s) addressed:

URSC07-30

Comment and Response: 44-6

Comment:

The commenter was responding to the Agencies prior comment that the loading analysis does not include lead.

Response:

The Agencies acknowledge that lead has been added to the Draft HTMA loading analysis. The comment does not affect selection of a remedy.

Unique comment(s) addressed:

URSC07-32

Comment and Response: 46-1

Comment:

The commenter states that the Agencies rejected Alternative 13M in part because it relies on monitored natural attenuation (MNA). The commenter states that all remedies rely on MNA and no collection system is 100% effective. The commenter goes on to state that Alternative 13M satisfies MTCA's preferences for containment of contaminated groundwater to be implemented to the maximum extent practicable.

Response:

Alternative 13M was rejected because it does not satisfy the threshold criteria for selection of a final remedy under CERCLA and MTCA, and for other reasons discussed in the ROD. As discussed above, CERCLA and MTCA require that groundwater discharging to surface water meet surface water cleanup standards before that portion of the hypoheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates. Under MTCA, Alternative 13M does not contain contaminated groundwater that discharges from Tailings Pile 2 and 3 into Railroad Creek; therefore, it does not satisfy AKART. Alternative 13M does not provide containment of contaminated groundwater to the maximum extent practicable; therefore, it does not satisfy MTCA requirements for a remedy to rely on natural attenuation. See WAC 173-340-370(7).

Unique comment(s) addressed:

TGAR01-05/06/24/32/33/35a, URSC07-13/17/18

Comment and Response: 46-2

Comment:

The commenter states that MNA is an active remedy under MTCA.

Response:

MTCA states that "A cleanup action that includes natural attenuation and conforms to the expectation in WAC 173-340-370(7) can be considered an active remedial measure" (WAC 173-340-200). The MTCA expectations referred to include (a) source control has been accomplished to the maximum extent practicable; (b) leaving contaminants on site during the restoration time frame does not pose an unacceptable risk to human health or the environment; and (c) there is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate at the site. The elements of Alternative 13M that rely on natural attenuation do not meet these expectations of WAC 173-340-370(7) and, therefore, cannot be considered an active remedial measure at the Site. In Alternative 13M (a) source control will not be accomplished for groundwater originating from TP-2 and TP-3, (b) the restoration time frame is estimated to be hundreds of years, and (c) the occurrence of natural biological or chemical degradation are not supported by the studies Intalco has presented.

Unique comment(s) addressed:

TGAR01-07, TGAR01-24, TGAR01-35, TGAR01-35a, TGAR01-35b, TGAR01-35c

Comment and Response: 46-3

Comment:

Several comments suggested that the Proposed Plan should make it clear that natural dilution and dispersion within groundwater is a permissible way to meet groundwater cleanup requirements for protection of surface water. One commenter cited a portion of the Responsiveness Summary for the Amendments to the Model Toxics Control Act Cleanup Regulation Chapter 173-340 WAC, dated February 1991:

> *"[a]though this provision will not provide for approval of an explicit dilution zone, Ecology believes that this approach [i.e., monitoring performed within the surface water] will provide for a 'de facto' dilution zone because of the relatively low ground water flows."*

Response:

The response to previous comments has noted why reliance on natural attenuation (e.g., dispersion and dilution) does not satisfy requirements for a permanent cleanup. The comment that referred to the Responsiveness Summary for the MTCA Amendments quoted only a portion of the Responsiveness Summary for Issue #13. In Ecology's original response, the sentence prior to the one quoted in the comment states, *"...where cleanup levels are based on protecting nearby surface waters, compliance with those standards will generally be based on surface water monitoring performed as close as possible to the ground water/surface water interface."*

The original regulation that was discussed in Issue #13 was that Ecology had suggested having the compliance point within groundwater and at an upland location. By moving the compliance point from within groundwater to the groundwater-surface water interface, it was suggested that Ecology had provided for a "de facto" dilution zone. There are two issues here: the first is that the elements of Alternative 13M that rely on natural attenuation ((e.g., dispersion and dilution) do not meet the MTCA expectations for source control to the maximum extent practicable [WAC 173-340-370(7)(a)]; and the second is that the samples collected by Intalco during the RI/FS do not represent "*surface water monitoring performed as close as possible to the ground water/surface water interface.*"

Unique comment(s) addressed:

TGAR01-31, INTA01-24, URSC07-13

Comment and Response: 46-4, 46-5 and 48-5

Comment:

Several comments stated that Intalco has shown that MNA is occurring at Holden. The commenter states that the natural geochemical processes that are expected to be occurring at the Site in combination with other remedial actions will reduce concentrations in the surface water to a level protective of the indigenous aquatic life. One comment goes on to cite Metal Attenuation Processes at Mining Sites (Wilken 2007) that hydrogeochemical processes (e.g., oxidation, precipitation, co-precipitation, and sorption) are well known and have been documented in similar environments and that these processes are expected to cause attenuation at the Holden Mine site.

The comments contend that the Agencies mistakenly dismiss natural attenuation as mere source depletion. The commenter states that acid rock drainage is "a natural weathering 'reaction' process *that comes within the CERCLA and MTCA definitions of natural attenuation...Through acid rock drainage the release of COPCs from the site sources will continue to decline over time as the available reactive sulfides are reduced by oxidation reactions and the availability of oxygen to remaining sulfides is reduced."*

Response:
The final Feasibility Study very carefully distinguishes the differences between a release of hazardous substances resulting from source depletion, and natural attenuation. The ongoing release of hazardous substances from weathering is not the same as naturally occurring mechanisms that mitigate the mass, volume, or concentration of hazardous substances that have already been released.

The explanation for acid rock drainage (ARD) provided in the comments notes that the release of hazardous substances will continue until available sulfides are reduced and available oxygen is reduced, i.e., for decades if not hundreds of years. Agency guidance for CERCLA and MTCA both describe natural attenuation as a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to *reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater* (emphasis added). Since ARD is the mechanism by which contaminants continue to be released to the environment, it does not constitute natural attenuation and is not an acceptable part of a cleanup.

The weathering process of mine tailings, waste rock, and on exposed rock surfaces within the mine, which creates ARD at the Site are very different from weathering of an undisturbed ore deposit. The metals and sulfates dissolution into groundwater is exacerbated from the significantly increased surface area of pulverized tailings, broken waste rock, and exposed stope walls that resulted from mining. Although ARD generation will reduce the source of hazardous substances over decades if not hundreds of years, the sources of this release need to be addressed by the remedy to protect human health and the environment.

The comment assumes that natural attenuation is occurring at the Site, without having monitored the parameters suggested in Wilken's and other guidance on natural attenuation of metals at mine sites. Therefore, the mechanisms, rates, reversibility, etc. of natural attenuation at the Holden Site are unknown and any prediction about the success of natural attenuation in achieving remedy goals at Holden is speculative.

Unique comment(s) addressed:
TGAR01-34, MWHA01-31/34, INTA01-28, TGAR01-35, URSC07-18/56, URSC04-04, TGAR01-08

Comment and Response: 48-1 and 50-3

Comment:
Some comments noted that sources of hazardous substances have been uncontained for over 50 years, yet groundwater within 100 feet downgradient of the tailings piles meets drinking water standards (e.g., it does not meet criteria in DS-2). This provides evidence of limited mobility of the contaminants and attenuation capacity of the aquifer.

Response:
Although groundwater downgradient of the tailings piles does meet drinking water criteria within a short distance downgradient of the tailings piles, it does not meet criteria for protection of aquatic life at locations where the groundwater is discharging into Railroad Creek.

Intalco did not provide evidence of natural attenuation for any specific mechanisms other than, potentially, dilution. There is no basis to assume natural attenuation is a reliable part of the cleanup proposed by Intalco. The use of natural attenuation for Alternative 13M does not satisfy the MTCA expectations for a permanent remedy, WAC 173-340-370(7).

Unique comment(s) addressed:
MWHA01-18, URSC07-11

Comment and Response: 48-2 and 48-3

Comment:
Intalco presented multiple regression analyses of data from select Holden Mine site wells in the Draft Hydrogeology Technical Memorandum Addendum in the Context of a Contingent Remedy (HTMA), dated February 24, 2010. The Agencies commented that the analyses were limited to 5 well clusters and none were located in a source area.

Previous comments by the Agencies on Alternative 13M noted that the regression analyses presented in the Draft HTMA were not reliable trend plots. The Agencies had noted that most of the plots that appear to have reasonable coefficients of determination are driven by two clusters of data.

One comment agreed that the majority of the data are clustered around 1997 to 1999 or 2008 to 2009. Another comment noted that wells with the longest analytical records were selected for the regression analysis. The comment also stated that insufficient data were available to include wells located in the source areas.

Response:
The Selected Remedy is based on available information that indicates a groundwater barrier wall is needed to contain groundwater impacted by releases from Tailings Piles 2 and 3. Additional data beyond those cited in the comment would be needed for a regression analysis, such as that presented in the HTMA, to be an acceptable line of evidence for a remedy, such as Alternative 13M, to rely on natural attenuation.

Unique comment(s) addressed:
URSC07-19/21, URSC07-20/23

Comment and Response: 48-4

Comment:
Intalco evaluated the potential relationship between precipitation and fluctuations in groundwater concentrations. It concluded that there is no obvious trend in precipitation that would explain changes in concentrations of COPCs observed in DS-3S/D and DS-4S/D.

Response:
Thank you for your comments. These comments do not affect selection of a remedy.

Unique comment(s) addressed:
URSC07-22

Comment and Response: 48-6

Comment:
The commenter supports Alternative 13M and said that it will be protective of aquatic life downstream of Tailings Piles 2 and 3 without implementation of the Phase 2 barrier wall around these two tailings piles. The comment contends that the Compliance Monitoring Program and Five-Year Review process are designed to confirm that remedial action objectives are being met.

Response:
The Selected Remedy is based on available information that indicates a groundwater barrier wall is needed to contain groundwater impacted by releases from Tailings Piles 2 and 3, to restore groundwater outside the WMA, and to protect aquatic life in Railroad Creek.

Compliance monitoring will be required during and following implementation of the remedy to evaluate effectiveness of the remedial actions and protectiveness of the remedy. Where remedies involve leaving hazardous substances on the Site, both MTCA and CERCLA require reviews every five years for as long as the remedy is needed.

There is currently no basis to show the second phase of the Selected Remedy is not needed. The Selected Remedy allows Intalco to collect additional monitoring data for up to three years if it wishes to attempt to show that the first phase of the remedy is sufficient to achieve cleanup requirements and that the second phase may be modified or omitted. This period is limited to three years so that the new data may be evaluated in the fourth year to determine whether the second phase can be modified, or whether it is needed. Unless new information collected in the first three years after the first phase clearly indicates cleanup goals will be met within a reasonable restoration time frame, the second phase of construction will be designed in the fifth year and implemented immediately thereafter.

Unique comment(s) addressed:
MWHA01-29

Comment and Response: 48-7

Comment:
The commenter was responding to the Agencies' prior comment on Alternative 13M that the groundwater contaminant plume downgradient of Tailings Pile 3 is not adequately characterized to support selection of a remedy that relies on monitored natural attenuation.

The commenter referred to the Baseline Characterization and Monitoring Program that is currently being implemented and indicated that the program would collect data to support the occurrence of natural attenuation.

Response:
The Selected Remedy is based on available information that indicates a groundwater barrier wall is needed to contain groundwater impacted by releases from Tailings Piles 2 and 3 to protect human health and the environment. The Agencies will consider additional information as it becomes available, and may modify the remedy through an ESD or a ROD Amendment, if appropriate.

Unique comment(s) addressed:
URSC07-02

<u>Comment and Response: 50-1 and 50-2</u>

Comment:
Intalco disagrees with the Proposed Plan (see p. 20) that groundwater must meet drinking water standards at the edge of a WMA. Holden Village does not use groundwater for drinking water and it is not reasonably foreseeable that it would do so since it has an abundant [surface] water supply.

It is unnecessary for the Agencies to apply drinking water standards at the immediate edge of TP-3 since the CERCLA Section 121 requirement to achieve drinking water standards is conditioned on these standards being relevant and appropriate under the circumstances of the release. Neither the CERCLA regulations nor the Preamble support the over-broad assertion that groundwater cleanup levels must be met outside the bounds of a WMA.

Response:
The availability of other sources of drinking water at the Site is not a consideration when determining beneficial uses of groundwater in the state, as determined under WAC 173-340-720.

The criteria presented in MTCA [WAC 173-340-720(1)(a)(2)] identify the beneficial use of groundwater at the Site as a potential source of drinking water is the basis for the cleanup except under certain specific circumstances that do not pertain to the Holden Site. At Lucerne, which is downgradient of the former mine but a part of the Site, groundwater is a current source of drinking water.

In accordance with CERCLA Section 121(d)(2)(B), 42 U.S.C. § 9621(d)(2)(B), and the NCP, Maximum Contaminant Levels (MCLs) under MTCA and the federal Safe Drinking Water Act (SDWA, 42 U.S.C. § 300 et seq.), therefore, are relevant and appropriate.

Unique comment(s) addressed:
HVWC02-05, HVWC02-06a, INTA01-23

<u>Comment and Response: 51-1, 51-2 and 51-8</u>

Comment:
Several comments expressed opinions on where the point of compliance should be set and how groundwater monitoring should be accomplished for protection of surface water at the Site, as summarized below:

- *Surface water criteria as measured in surface water were developed to be protective of aquatic life. Concentrations measured in surface water near the groundwater-surface water* *interface meet ARARs. Surface water cleanup levels should be applied in surface water, not groundwater, and therefore the point of compliance should be in surface water.*

- *The chemical-specific surface water ARARs proposed for the Holden Mine site were developed to be protective of aquatic life, including fish spawning and the benthic community. The applicable federal and state surface water quality criteria provide cleanup levels that are protective of aquatic life and benthic communities. Where surface water samples collected using standard surface water sampling procedures are below these cleanup levels for COCs the aquatic life and benthic communities are protected.*

- *WAC 173-340-720(8)(d)(i)(B) requires a demonstration that it is not practicable to meet the cleanup level within groundwater before entering surface water; this would be nonsensical if Ecology did not have authority to allow a conditional point of compliance within the surface water.*

- *WAC 173-340-720(8)(d)(i) unambiguously allows compliance with surface water cleanup levels to be determined at a point that is actually within surface water.*

- *Ecology can set a CPOC within surface water (provided it does not result in violation of standards within the water body), without concern that this may allow dilution within the groundwater just before it enters the surface water.*

- *Documentation during the process of developing the MTCA amendments indicates Ecology's intent was to measure concentrations in surface water for protection of surface water. Monitor surface water for surface water compliance; if groundwater is monitored then the Agencies should consider an estimate of the natural attenuation between the well and where groundwater discharges to surface water.*

- *The Proposed Plan should be revised to make it clear that groundwater does not need to be cleaned up to meet surface water standards before groundwater is discharged to surface water. This is consistent with MTCA (WAC 173-340-720(8)(d)(i)). WAC 173-340-720(1)(c) does not require groundwater to be remediated to surface water standards before it enters surface water.*

Response:
Hazardous substance concentrations in groundwater discharging into Railroad Creek from releases from Tailings Piles 2 and 3 exceed levels that are protective of aquatic life. Under CERCLA, for protection of surface water, the state's stream classification for protection of site-specific uses, that could be impacted by groundwater discharging into the surface water, must be considered.[1] At a minimum, this includes meeting drinking water standards at and beyond the edge of a WMA and preventing receptors in the creeks from being exposed to groundwater that exceeds aquatic life

[1] In this case, the Washington State regulations [WAC 173-201A-200 and -600] require protection of Railroad Creek's and Copper Creek's designated beneficial uses. Per WAC 173-201A-600, the following are the designated beneficial uses of surface water at the Site (use categories in parentheses): aquatic life (salmonid spawning, rearing, migration, and core summer habitat), recreation (extraordinary primary contact), water supply (domestic, industrial, agricultural, and stock watering), and miscellaneous (wildlife habitat, harvesting, commerce and navigation, boating, and aesthetic value).

protection criteria (see the NCP preamble [55 FR 8713]). Under MTCA, groundwater cleanup levels must be at least as stringent as concentrations protective of surface water in situations where hazardous substances are likely to reach surface water without cleanup actions being implemented (WAC 173-340-720(3)(b)(iv) and WAC 173-340-720(4)(b)(ii)). Further, cross-media impacts must also be considered and cleanup levels must be established at concentrations that prevent violations of cleanup levels for other media (WAC 173-340-700(6)(b) and 173-340-702(8)). Thus, for the purpose of protection of surface water at the Holden Mine Site, cleanup levels established for the protection of aquatic life must be met before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates.

MTCA (WAC 173-340-720(8)) sets forth requirements for conditional point of compliance (CPOC) location determinations. Point of compliance (POC) or CPOC location determinations must satisfy one of the following three categories:

(1) Groundwater cleanup levels—including those based on surface water criteria—must be met at the standard point of compliance, "throughout the site," unless it is not practicable to meet the cleanup level throughout the site within a reasonable restoration time frame (WAC 173-340-720(8)(b)). (This is not practicable for the Holden Mine Site.)
(2) MTCA allows for the establishment of a conditional point of compliance and indicates that this conditional point of compliance "shall be as close as practicable to the source of hazardous substances," provided that all practicable methods of treatment are used in the site cleanup (WAC 173-340-720(8)(c). (The Selected Remedy qualifies for this category.)
(3) Where the groundwater cleanup level is based on protection of surface water beneficial uses and the property containing the source of contamination directly abuts the surface water, as it does at Holden, Ecology may approve a conditional point of compliance that is located within the surface water as close as technically possible to the point or points where groundwater flows into the surface water, provided ALL of the following conditions are met (WAC 173-340-720(8)(d)(i):
    a. Demonstration that groundwater is entering the surface water and will continue to enter the surface water even after implementation of the selected cleanup remedy;
    b. Demonstration that it is not practicable to meet cleanup levels within a reasonable restoration time frame;
    c. A mixing zone is not allowed;
    d. AKART requirements will be satisfied;
    e. Sediment quality standards must not be exceeded;
    f. Long-term groundwater and surface water monitoring is required;
    g. Notice of proposal to required parties and consideration of comments is required; and
    h. In addition to the above conditions, the department may require upland monitoring wells along with an estimate of natural attenuation to be used to determine whether compliance has been achieved, provided an evaluation of whether short-circuiting (preferential) pathways exist and whether changes in water chemistry would reverse attenuation and cause an exceedance (WAC 173-340-720(8)(e)).

The conditions in item three above are not met at the Holden Mine Site, thus the selected point of compliance is based on WAC 173-340-720(8)(c).

At Holden, it is practicable to meet cleanup levels at a point within groundwater beyond the barrier walls of the Selected Remedy, prior to discharge to surface water. The installation of such barrier walls constitutes a known, available, and reasonable method of treatment. As such, the sample(s) collected at RC-5 represent a mixed condition within the surface water that is not representative of an allowable point of compliance under WAC 173-340-720(8)(d)(i).

The point of compliance for protection of surface water must be within groundwater before that portion of the hypoheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates to be protective.

Unique comment(s) addressed:
URSC07-08, URSC07-10, INTA01-21, HVWC02-3d, MWHA01-32, URSC07-14, HVWC02-3b, HVWC-02-3a, HVWC02-3c

Comment and Response: 51-3 and 51-5

Comment:
The commenter states that a remedy that does not collect and treat contaminated groundwater entering surface water from Tailings Piles 2 and 3—such as Alternative 13M—could be selected by the Agencies even if this remedy did not meet ARARs. The commenter cites 40 C.F.R. § 300.430(f)(l)(C)(6) and states that a remedial alternative that does not meet an ARAR under state law may be selected "if the state has not consistently applied...the promulgated requirement in similar circumstances at other remedial actions within the state." The commenter states that Ecology and EPA do not consistently require collection and treatment of all contaminated groundwater entering surface water where groundwater levels exceed surface water ARARs. The commenter lists seven sites (Commencement Bay, Midnite Mine, Hanford 100 N Area, NUWC Keyport, Iroquois Mine, Melrose Mine, and Napoleon Mine/Mill) and states that at these sites "the remedy selected by Ecology and/or EPA does not prevent the discharge to surface water of all groundwater exceeding surface water quality standards."

Response:
The Agencies first note that their rejection of Alternative 13M does not hinge solely on its not meeting state ARARs (i.e., Washington State Water Quality Standards for Surface Water and MTCA). In addition to Alternative 13M not meeting threshold criteria for selection under MTCA, this alternative does not meet the threshold criteria under CERCLA. Groundwater impacted by releases from Tailings Piles 2 and 3 exceeds MCLs and federal aquatic life protection criteria, and contributes to the extensive adverse impacts to the aquatic environment in Railroad Creek. As described in Section 10.1.1 of the ROD, there is no evidence that Alternative 13M would meet proposed surface water cleanup levels in groundwater before it enters Railroad Creek. Therefore, there is no evidence that groundwater entering Railroad Creek would be protective of aquatic life adjacent to and downgradient of the tailings piles or that it would meet federal surface water ARARs (e.g., NWQC).

The Agencies further note that state requirements do not necessarily call for the collection and treatment of all impacted groundwater at every site. Under MTCA (and CERCLA), an RI/FS is conducted to determine the best remedy for the specific circumstances at each site. The fact that the selected remedies differ at various sites is not evidence that the state has inconsistently applied its requirements.

Finally, the Agencies reject the commenter's suggestion that the specific examples cited are evidence of the state's inconsistent application of its requirements. These are discussed briefly as follows:

- The cleanup at the Commencement Bay site does not support the commenter's statement that the state has inconsistently applied its cleanup requirements. As reflected in the ROD for this site, a groundwater conditional point of compliance (CPOC) was established in accordance with the MTCA criteria. The CPOC is set at the interface of the surface water and the shoreline of Commencement Bay and the Yacht Basin; specifically, it is set at the interface between the slag or any overlying shoreline armoring materials and the surface water. In addition, the ROD establishes specific monitoring protocol which includes collection of groundwater samples from a series of coastal wells and comparison of results with surface water cleanup levels, allowing for the effects of dilution and attenuation between the wells and the CPOC.

- The Midnite Mine cleanup also does not support the commenter's statement that the state has inconsistently applied its cleanup requirements. At this site, groundwater exceeding surface water ARARs is to be contained and treated. The only impacted groundwater that will not be treated is the water outside the groundwater containment, which will be allowed to naturally attenuate. This is a similar approach to that of the preferred alternative for the Holden Site.

- At the Hanford 100-N Area, a final remedy has not yet been determined (the site is under an interim ROD). Because of this, this example does not support the commenter's statement that the state has inconsistently applied its cleanup requirements.

- The ROD for OU 1 (Area 1) at NUWC Keyport similarly does not support the commenter's statement that the state has inconsistently applied its cleanup requirements. At this site, PCBs were detected in a seep and an adjacent surface water station at concentrations exceeding surface water standards. However, sediment sampling and fate and transport considerations indicated that the PCBs entering surface water became rapidly adsorbed to sediment in the immediate vicinity of the seep. In addition, evaluations of the effect of the surface water exceedances on aquatic organisms, including sediment analysis, bioassays, comparison of tissue concentrations to tissue-based toxicity values, and food chain modeling concluded that ecological risk associated with the PCB discharges were below levels of concern. Nonetheless, the selected remedy—which was compliant with MTCA—included removal of the impacted sediments to reduce potential risks even further along with long-term monitoring to evaluate potential future sediment recontamination and ecological risk and contingent action should unacceptable risks ever develop in the future. The ROD established a CPOC in accordance with MTCA and outlined specific monitoring protocols which included collection of groundwater samples from a series of coastal wells and comparison of results with surface water cleanup levels, allowing for the effects of dilution and attenuation between the wells and the CPOC.

- The ROD for OU2 (Area 8) at NUWC Keyport also does not support the commenter's statement that the state has inconsistently applied its cleanup requirements. At this site, the ecological risk assessment concluded that, although there were some elevated concentrations of contaminants in groundwater and seeps near the shoreline with Liberty

Bay, these discharges were not associated with significant risk to organisms (based on analysis of sediments and tissues). The remedy for this site included removal of soil hot spots and monitoring of groundwater, seeps, and the marine environment.

- The investigations at the Iroquois Mine, Melrose Mine, and Napoleon Mine/Mill were Preliminary Assessments (PAs) and Site Inspections (SIs) conducted by EPA. This work was not carried out by Ecology or other state agency. The results of a PA/SI are used by EPA to evaluate the potential of a release of hazardous substances from a site, assess the need for additional detailed investigation and/or response action, and determine the potential for placement of the site on the federal National Priorities List (NPL). At these three sites, EPA determined that no additional data collection was needed at that time and that the potential threats posed by these sites did not warrant placement on the NPL. The evaluation of these sites by EPA does not support the commenter's statement that the state has inconsistently applied its cleanup requirements.

Unique comment(s) addressed:
TGAR01-41, TGAR01-41b,

Comment and Response: 51-4

Comment:
The Agencies' 2005 submittal to NRRB did not include a barrier around TP-2, indicating Agencies did not believe MTCA required collection and treatment of all groundwater at Holden.

Response:
The 2005 Site Information Package the Agencies submitted to the NRRB presented a plan that the Agencies then believed would satisfy cleanup requirements. Comments from the NRRB and others on the deficiencies of the draft RI/FS and the then-proposed remedy led to further study and development of new and refined cleanup alternatives. The final Feasibility Study and comments on the Proposed Plan are the basis for the Selected Remedy, as described in the ROD.

Unique comment(s) addressed:
TGAR01-41a

Comment and Response: 51-06

Comment:
The MTCA conditional point of compliance regulation has not been applied consistently at other sites to require a barrier wall for groundwater collection and treatment.

Response:
The MTCA regulations that address establishment of a conditional POC do not specifically require a barrier wall for groundwater cleanup and treatment.

However, groundwater barriers are effective, and are commonly used, to meet cleanup standards. The decision to use a barrier wall is based on site-specific conditions that differ from site to site.

Unique comment(s) addressed:
TGAR01-02

Comment and Response: 51-07

Comment:
The commenter asserts that the Agencies are incorrect in believing a remedy cannot meet threshold requirements partially or primarily by dilution and dispersion within groundwater before it emergences into surface water. For instance, WAC 173-340-720(8)(e) requires consideration of natural attenuation between a monitoring well and the points where groundwater flows into surface water, in evaluating whether compliance has been achieved.

Regulatory history, notably the MTCA Policy Advisory Committee, makes it clear that dilution is acceptable as a method to meet cleanup goals.

Response:
A remedy can rely on natural attenuation (including dilution and dispersion) provided AKART is satisfied. At Holden, active measures are required since the contaminated groundwater will not be below cleanup levels prior to entering Railroad Creek. Dilution and dispersion within groundwater are forms of natural attenuation; however, cleanup actions are expected to use active measures to prevent/minimize discharges in excess of cleanup levels to surface water via groundwater and to not rely solely on dilution and dispersion (WAC 173-340-360(2)(g) and 173-340-360(6)). A natural attenuation evaluation may be performed to estimate natural attenuation; however, Intalco has not demonstrated that natural attenuation in groundwater is protective of surface water in Railroad Creek or the wetland east of Tailings Pile 3. WAC 173-340-200 (natural attenuation definition) and Ecology and EPA guidance discuss other natural attenuation mechanisms and methods for evaluation.

Unique comment(s) addressed:
HVWC02-04, HVWC-02-4a

Comment and Response: 52-1

Comment:
Several comments noted that this remediation process is an opportunity for public education about ecological and environmental support, best practice standards for mining, etc. One commenter references the Britannia Mine in BC as an example of the importance of public education and communication.

Response:
Comments noted.

Unique comment(s) addressed:
CKAI01-03, TPER02-01, RDUN01-03

Comment and Response: 53-3

Comment:
Will the Agencies be hiring within community to work on the remediation project? It would be nice to have community involvement as well.

Response:
Intalco will hire the remediation contractor(s), and has already begun the process of talking with local companies. The Agencies will likely rely on their existing staff and consultants to oversee remedy implementation.

Unique comment(s) addressed:
RLLO01-01

Comment and Response: 53-6

Comment:
A long-term solution must have a component that addresses overflow and stream protection. A retaining wall to function in emergency conditions must be available to protect the stream.

Response:
Remedial design will consider flood events and include features to protect remediation infrastructure and prevent erosion or scour from causing instability of the tailings piles that would release hazardous substances into Railroad Creek. A retaining wall along the toe of the tailings piles is not needed since the Selected Remedy includes moving the stream away from the tailings piles, as well as design of the new channel to handle most flood events. During Remedial Design, Intalco will evaluate the type of stabilization (e.g., a buttress, subgrade improvement; or other acceptable approach) that is needed to protect the stream.

Unique comment(s) addressed:
MBAR01-02

Comment and Response: 53-8

Comment:
When my time and budget allow, would like to have a chat about several ideas.

Response:
Comment noted. Please contact the Agencies if you have ideas on how the Selected Remedy can be improved during design or through a ROD Amendment or ESD.

Unique comment(s) addressed:
MTLU01-02

Comment and Response: 53-9

Comment:
Need to make sure that after the remedy is in place, it is maintainable and built to be sustainable by Holden Village and the Agencies when it comes to monitoring and water treatment plants and so forth. The remedy needs to focus on the future, not just construction.

Response:
The Selected Remedy is suitable for conditions at the Site (remote location, climate, etc.); can be maintained by commercially available sources; and is compatible with anticipated future use of the Site by the Forest Service and Holden Village. Generally, where there is a responsible party such as Intalco, the responsible party is obligated to conduct the necessary monitoring and operations.

Unique comment(s) addressed:
PISE01-01

Comment and Response: 53-12

Comment:
Revegetation of tailings piles will help rehabilitate Railroad Creek.

Response:
Comment noted. The Agencies agree that regrading and other measures to provide stable slopes including establishing a self-sustaining native vegetation cover, will help protect Railroad Creek.

Unique comment(s) addressed:
BSAK01-03

Comment and Response: 54-1

Comment:
Holden Village continues to be supportive of the overall mine remediation effort and wishes to accommodate and contribute to this effort.

Response:
Comments noted. Thank you for your support.

Unique comment(s) addressed:
HVWC09-01, HVWC08-01

Comment and Response: 54-2

Comment:
Several comments expressed support for moving forward with the remediation and are appreciative that a plan is coming together.

Response:
Comments noted. Thank you for your response.

Unique comment(s) addressed:
BOLS01-01, CKOM01-01, DBLO01-02, JQUE01-02, KAND01-01, SSTE01-03, TWAG02-03

Comment and Response: 55-1, 55-2, 55-3, 55-4, 55-5 and 55-6

Comment:
Several comments supported Alternative 14 based on the proposed construction phasing of a 2-year construction period followed by a 5-year break for monitoring before additional major construction, since this proposed phasing will allow Holden Village to remain viable. Several comments support Alternative 14 as the Preferred Alternative because it does the least harm to Holden Village's ongoing programs and activities. The comments indicate that Holden Village wants to work with the Agencies and Intalco even if this means sharply curtailing ministries for 1 to 2 seasons.

Some comments thanked the Agencies for listening to the local community's input on issues essential to its viability, and adjusting the preferred alternative to accommodate the community's needs.

Response:
Thank you for your comment. The Selected Remedy includes the phased construction proposed for Alternative 14 to reduce potential adverse impacts on Holden Village.

Unique comment(s) addressed:
HVWC01-01, HVWC01-02, BSAK01-04, GMAT01-03, JMAT01-02, KSAL01-01, LROE01-01, SBAL01-01, TRAN01-01, WGID01-01, WGID02-01, WGID02-05, RDJE01-02, CBRO01-02, DELL01-02, LGSP01-01 CJNA01-03, HOGR01-03, KROH01-01

Comment and Response: 55-7

Comment:
You have heard a lot of support for Alternative 14 but that support is really based on the faith that the folks implementing this will work together in a sensible way to do something that works and makes sense. Support for Alternative 14 is conditioned on you (the Agencies) being reasonable folks.

Response:
Comment noted.

Unique comment(s) addressed:
TANE01-04

Comment and Response: 55-8, 55-9, 55-17 and 55-21

Comment:
Several commenters supported the phased approach of a 2-year construction period followed by 5-year break in construction (that some comments attributed to be for monitoring to determine whether or not the Tailings Piles 2 and 3 barrier wall will be necessary).

The comments note that both the 2-year construction period and the 5-year break are important to Holden Village's short-term and long-term viability both financially and for their volunteer base.

Response:
The Selected Remedy is divided into two phases of heavy construction to reduce the potential adverse impacts of construction on Holden Village. Although existing information fully supports the need for the second phase of groundwater barrier wall construction, Intalco may elect to use the first three years following completion of the first phase to collect additional data that it believes may demonstrate that the second phase groundwater barrier can be modified or omitted.

It is important to note that although Intalco has indicated it can accomplish the first phase of remedial construction in two years of heavy construction, this is predicated on two years of initial preparations (that also involve some construction) including road improvements, work in the mine, preparation of staging areas, dock improvements, quarry development, etc. There are also some circumstances (e.g., shutdowns for forest fires) that could lead to an extension in the time required for preconstruction preparations or for the first phase of major construction.

Finally, the Selected Remedy is based on available information that indicates the second phase groundwater barrier wall is needed to contain groundwater impacted by releases from Tailings Piles 2 and 3 to protect human health and the environment.

Unique comment(s) addressed:
AMCC01-01, CCAL01-02, CHIN01-02, CKAI01-02, CSCH01-03, DJOH01-03, DMFA01-02, KBLO01-01, LGOC01-01, MWAG01-03, POLS01-01, TSMI01-03, TWAG01-02 CCAR01-01, GMAT01-04, HBMC02-07, KBLO01-03, LCOL01-03, MMAN02-02, MSCH01-01, MSCH01-02, OMAT01-03, PHAI01-01, RGID01-05, TRAN01-02, TWAG02-02, HVWC04-01, KAND01-02

Comment and Response: 55-10, 55-16 and 55-22

Comment:
One comment expressed concern that while implementing the remedy may require only 2 years on paper, it might take a whole lot longer than that, and that would be detrimental to Holden Village.

The comments ask that the Agencies consider other remedy tasks that could be phased or deferred in the event Phase 1 runs the risk of extending beyond 2 years. These risks include natural events (floods, fire, or record snowfall) which could lead to delays. It seems prudent to have a "Plan B" to ensure Phase 1 is only 2 years.

One comment expressed concern that any "solution" may have a greater negative impact than the "problem." If the remediation impacts the Village over too extended a period, there will be trouble "restarting" the Village's program and this would greatly reduce the current levels of support and visitors.

Response:
Comments noted. In the event of uncontrollable delays, the Agencies will work with Intalco and Holden Village to reduce the adverse impacts of construction.

Unique comment(s) addressed:
MSCH01-03, PBAN01-04, CJNA01-02

Comment and Response: 55-12

Comment:
Commenters support the approach of implementing early actions for remedy as it will improve the chances that heavy construction can be limited to 2 years or less, as planned. The comments asked that early actions be closely coordinated with Holden Village to ensure these are carried out in a manner that does not unreasonably interfere with Holden Village life and operations.

Response:
Comment noted. The Agencies are working with both Holden Village and Intalco to coordinate remedial design and plans for construction.

Unique comment(s) addressed:
HVWC01-07, PHAI02-01

Comment and Response: 55-18 and 55-20

Comment:
One comment expressed the expectation that remediation and creek cleanup will take many more than 5 years to complete; require new readings, experiments, and reassessment along the way; and should make use of new technologies as they become available.

Another comment expressed appreciation for the "get it done quickly but get it done" comments. There's only a guaranteed 5-year period of no construction. What are the chances more will be decided has to happen in 2018 and what will it look like in 2020? Would that be more years of construction?

Response:
Monitoring will be required during and following implementation of the remedy to evaluate effectiveness of the remedial actions and protectiveness of the remedy. Where remedies involve leaving hazardous substances on Site, both MTCA and CERCLA require reviews every five years for as long as the remedy is needed. This review provides an opportunity to revise the remedy, if appropriate.

At this time there is no reason to expect more remedial construction will be required than is included in the Selected Remedy.

Unique comment(s) addressed:
JMAT01-06, WPQA01-04

Comment and Response: 55-19

Comment:
Several comments indicated the commenter wanted to see remediation completed as quickly and efficiently as possible. One commenter would like to see alternatives evaluated on how rapidly and how efficiently the project can be completed to find the most efficient way to complete the project.

Response:
The Selected Remedy is based on the alternative that best protects human health and the environment, in accordance with both state and federal regulations. The time required to achieve cleanup, including both short-term effectiveness, long-term effectiveness, and permanence of the alternatives was evaluated in the final Feasibility Study, and is summarized in the Proposed Plan and the ROD.

Unique comment(s) addressed:
KBAR01-01, BDIA01-01, PONE01-01, MLEE01-03

Comment and Response: 55-24

Comment:
Several comments expressed support for the remediation effort and getting it done quickly, with a preference for 2-year time frame.

Response:
Thank you for supporting the remediation effort.

The Selected Remedy includes two phases of construction to reduce the potential adverse impacts of construction on Holden Village. It is not possible to complete remedial construction in only two years, but the Agencies and Intalco are working to limit the first phase of heavy construction to just two years.

Unique comment(s) addressed:
AFCO01-01, BDIA01-01

Comment and Response: 55-23, 55-24 and 55-25

Comment:
The Proposed Plan discusses that the 5-year break between major phases of construction is necessary to determine if the additional groundwater cutoff wall is necessary. As this comports with Holden Village's requests concerning the minimum necessary for our viability, we support the Agencies' decision to allow time to see if the wall is really necessary.

Response:
The Agencies decided to implement remedial construction in two phases separated by a period of five years to reduce potential adverse construction impacts on Holden Village. The five-year period is not intended to determine whether the second phase of construction is necessary. As discussed in the Proposed Plan, hazardous substances would continue to be released into groundwater that discharges into Railroad Creek above cleanup levels without the groundwater barrier downgradient of Tailings Piles 2 and 3. However, the Agencies will consider any data collected during the interim between phases. As discussed in other responses, data collected could lead to modifications of the Phase 2 work.

Unique comment(s) addressed:
HVWC01-10, WGID01-02, WGID02-02

Comment and Response: 55-26

Comment:

Comments that favor limiting on the duration of remediation are unrealistic. A cleanup of this magnitude simply cannot be limited to such a short time at a site of this magnitude.

Response:

Comment noted. The Agencies will review Intalco's proposed schedule for remedial design and construction. The remediation schedule will be adjusted as needed to complete all needed work in a timely manner. Estimated construction durations discussed in the Proposed Plan and related documents are based on similar experience at other sites. While the Agencies will address RAO # 6 and consider scheduling to limit the disruption to Holden Village, the schedule will not be constrained to limit the cleanup work that must be completed.

Unique comment(s) addressed:

NPEC01-03

Comment and Response: 56-1

Comment:

Alternative 11M puts the very existence of the local community at risk and fails to take the local community's concerns into account. Alternative 11M was not vetted with the local community during its development and we were not permitted input. Alternative 11M poses extreme risk to Holden Village's continued existence due to the number of construction seasons required and the much greater degree of heavy construction that will occur in relatively close proximity to Holden Village. We ask that the Agencies reconsider their decision to go forward with a proposed plan based on Alternative 11M and resume a constructive dialogue with all parties aimed at developing a Proposed Plan that is more acceptable to the local community.

Alternative 13M was developed following discussions with Holden Village about what would and would not be workable. Alternative 13M would be implemented in well less than two construction seasons and perhaps as little as one. This gives Holden Village a fighting chance at getting through remedy construction with our community intact. Due to the considerable advantages of Alternative 13M we hoped the Agencies would bridge any differences with Intalco so Alternative 13M could form the basis of the Proposed Plan.

The Proposed Plan notes Holden Village has provided input throughout the FS process without any details. It bears mentioning that the local community has consistently expressed strong opposition to Alternative 11M and support for Alternative 13M. Please incorporate our previous comments into your consideration of the "community acceptance" modifying criterion. Please note Holden Village community remains adamantly opposed to Alternative 11M for reasons previously specified and not the grounds put forward by community members in the public meetings.

Response:

The Agencies have consistently communicated with Holden Village during the RI/FS process and plan to continue to do so during Remedial Design, construction planning, and thereafter.

The Agencies understand that there are concerns about the impact of remedial construction on Holden Village; therefore, the Selected Remedy will be constructed in two phases to reduce the impact of construction on Holden Village.

The Selected Remedy is (and the Proposed Plan was) based on Alternative 14, not Alternative 11M, and it differs substantially from Alternative 11M. The Selected Remedy was selected to best clean up the Site, using the remedy selection criteria established under CERCLA and MTCA. Overall, Alternative 14 provided a more complete cleanup than Alternative 13M, and better satisfied the remedy selection criteria than either Alternative 11M or 13M.

Unique comment(s) addressed:
HVWC05-01, HVWC05-03, HVWC06-01, HVWC01-06

Comment and Response: 56-2

Comment:
Holden Village assumes its alleged status as a PRP will not be a basis for discounting our comments as to the adverse impacts on the local community of implementation and long-term operations and maintenance. As Holden Village cannot be realistically looked to for significant portions of the remedy's implementation, operation, and maintenance (due to obvious limitations), Holden Village has no incentive to opine on potential remedies from the view of a PRP that might be attracted to less costly options due to potential savings.

Response:
The Agencies based development of the Selected Remedy on both technical and regulatory considerations. The schedule for implementing the cleanup includes minimizing potential adverse impacts to the community.

The Agencies appreciate and have considered comments on the Proposed Plan received from Holden Village. The Agencies have not “discounted” any comments received, regardless of source.

Unique comment(s) addressed:
HVWC07-03

Comment and Response: 56-3

Comment:
The costs presented for Alternative 14 are disproportionate.

Response:
The Agencies disagree with the assertion that the additional environmental benefit of Alternative 14 is disproportionate with the estimated cost. Among other matters, without the barrier wall along Tailings Piles 2 and 3, contaminated groundwater from beneath Tailings Pile 3 and at least part of Tailings Pile 2 would continue to discharge untreated into Railroad Creek under Alternative 13M for an unknown amount of time at levels that do not meet surface water quality standards (ARARs).

Further, a disproportionate cost analysis under MTCA (and the balancing criteria under CERCLA) are only applied to compare remedial alternatives that satisfy the threshold criteria under CERCLA and

MTCA. The Agencies rejected Alternative 13M because it does not satisfy the threshold criteria for selection of a final remedy under CERCLA and MTCA (and for other reasons discussed in the ROD).

Unique comment(s) addressed:
TGAR01-11

Comment and Response: 56-4

Comment:
Two commenters expressed support for extending the public comment period on the Proposed Plan.

Response:
The Agencies did extend the period allowed for comment on the Proposed Plan. More than 900 comments were received, which suggests that there was adequate time for the public to review and comment.

Unique comment(s) addressed:
PHIN02-02, TANE01-01

Comment and Response: 56-5

Comment:
Agencies failed to communicate with Intalco during development of Alternatives 10, 11, and 14.

Response:
The Agencies disagree with the assertion that Intalco did not have sufficient input into development of remedial alternatives. The Agencies communicated with Intalco on many occasions to discuss shortcomings in the alternatives proposed by Intalco. The Agencies then developed additional alternatives to address deficiencies in Intalco's feasibility studies.

Unique comment(s) addressed:
TGAR01-01

Comment and Response: 56-6

Comment:
Holden Village is a community, which is particularly important because one of the major elements of community acceptance as one of the modifying criteria in this process for Holden Village is the issue of no more than 2 years of heavy construction seasons and at least a 5-year break between any additional phases if needed. The Proposed Plan prescribes that and we support it.

Phased remedy is essential for the local community, and community acceptance is an essential part of considerations under CERCLA.

Response:
The Agencies would like to reduce adverse impacts to Holden Village by dividing remedial construction into two phases as discussed in the ROD. While the Agencies would like to complete the first phase of heavy construction in just two years, this will depend in part on Intalco's

construction plans and contract arrangements, and could be disrupted by circumstances that are beyond anyone's control (such as a forest fire). The Agencies will continue to communicate with Holden Village to reduce the disruptive effects of construction to the extent practical.

Unique comment(s) addressed:
PHAI03-02, TWAG01-03

Comment and Response: 56-7

Comment:
Alternatives 13M and 14 address all significant sources of impacted groundwater as shown by similar overall performance and restoration time frame as Alternatives 9 and 11.

Response:
Alternative 13M does not fully address containment or collection for treatment of impacted groundwater below Tailings Piles 2 and 3. Alternative 14 addresses this issue with a fully penetrating groundwater barrier wall and collection and treatment of groundwater impacted by releases from all parts of the Site. As a result there are significant differences in the overall performance and restoration time frame that the commenter does not recognize.

Unique comment(s) addressed:
TGAR01-36

Comment and Response: 56-8

Comment:
Alternatives 9 and 11 would both be protective of resident aquatic species in Railroad Creek in the short term.

Response:

Alternative 9 does not fully contain or treat all the sources of groundwater impacted by the release of hazardous substances. Although Alternative 11M would collect and treat substantially more contaminated groundwater than Alternative 9, Alternative 14, which is the basis for the Selected Remedy, would overall be more protective of human health and the environment (including the aquatic environment in Railroad Creek) than Alternative 11M.

Unique comment(s) addressed:
TGAR01-37

Comment and Response: 56-9 and 56-10

Comment:
Alternative 14 was not held to the same burden of proof as Alternatives 9 and 13M.

Response:
All of the alternatives discussed in the Proposed Plan were analyzed using the same CERCLA and MTCA criteria and the same technical methods and were, therefore, subjected to the same burden of proof.

Unique comment(s) addressed:
TGAR01-12, HVWC05-04

Comment and Response: 56-11

Comment:
After evaluating both the APR (Alt. 10) and Alt. 3b in considerable detail, Holden Village believes that either remedy would be acceptable from an environmental protection and restoration standpoint.

Response:
Comment noted. The description of alternatives in Section 9 of the ROD states that Alternatives 1 through 10 and their sub-alternatives were not acceptable as a final remedial action (Forest Service 2007d); therefore, they were not carried forward and discussed in the comparative analysis of alternatives section of the Proposed Plan and are not formally evaluated in this ROD.

Unique comment(s) addressed:
HVWC07-04

Comment and Response: 56-12 and 56-13

Comment:
We believe information regarding impacts to Holden Village (noise, traffic, and O&M staffing) is urgently needed so potential impacts on the local community can be assessed and incorporated into the remedy selection process.

The remedy should take into account adverse impacts on the environment and affected community. The Proposed Plan does not consider negative consequences (resources and energy) needed to implement Alt. 14.

The Proposed Plan has adverse impacts that have not been considered; the Agencies should evaluate and select the components that best benefit human health and the environment as a whole.

Response:
Potential adverse impacts of implementing the cleanup were discussed briefly in the Proposed Plan, and in more detail in the final Feasibility Study, and were considered in the remedy selection process as required by both CERCLA and MTCA. Potential adverse impacts of implementing the Selected Remedy include road traffic, barge traffic, risk of fuel and/or chemical spills, air quality (dust and emissions), noise, impacts on existing Holden Village operations and facilities, visual impacts, recreation impacts, and availability of local resources and services. Such impacts can and will be mitigated by planning and implementation of management practices during remedial construction. The Selected Remedy will be more protective and more sustainable than other alternatives that do not fully clean up the Site (e.g., Alternative 13M), or that would accomplish cleanup with larger potentially adverse impacts (e.g., Alternative 11M).

The Agencies have concluded that the benefits to human health and the environment of the Selected Remedy outweigh the potential adverse environmental impacts to a greater degree than other alternatives.

Unique comment(s) addressed:
HVWC08-08, INTA01-64, TARG01-55, TARG01-15

Comment and Response: 56-14

Comment:
The Proposed Plan does not adequately justify selection of Alternative 14. Intalco requests opportunity to comment if new justification is developed.

Response:
The Agencies disagree that the Proposed Plan did not provide adequate justification for remedy selection. The Proposed Plan appropriately summarized the RI/FS. This ROD documents the remedy selection, which was accomplished in accordance with CERCLA and MTCA. The ROD is based on the complete administrative record.

Unique comment(s) addressed:
TGAR01-14

Comment and Response: 56-15, 56-16 and 56-17

Comment:
Certain compounds of iron and aluminum are on the CERCLA hazardous substances list, but none of these compounds were disposed of by Howe Sound - so there is no legal basis for requiring remedial action to address iron and aluminum.

The MTCA statute also does not define iron and aluminum as hazardous substances. The MTCA statute defines hazardous substances in RCW 70.105D.020(7). None of the categories listed apply to iron and aluminum sulfide and silicate compounds, since the State has not designated these compounds as hazardous constituents under any of the enumerated State programs, nor are these compounds listed in the federal regulations that are incorporated by reference. Indeed, the MTCA regulations specifically list aluminum as an inert waste. See WAC 173-350-990(2)(f).

The listed hazardous iron and aluminum compounds did not form immediately after disposal of non-hazardous substance by Howe Sound.

The Forest Service has confirmed that iron and aluminum are not hazardous substances and response actions taken to address them as pollutants or contaminants are not reimbursable by a private party. Case law confirms a defendant is not liable under CERCLA for disposal of non-hazardous compounds where another force causes generation of hazardous compounds.

ARD processes do not generate the iron and aluminum solids listed as hazardous substances.

Response:
Data developed during the RI/FS indicate adverse impacts to both fish and benthic macroinvertebrates in Railroad Creek, including impacts from the release of iron and aluminum compounds (which are hazardous substances) from wastes (tailings) generated by the former mining activities. This includes impacts from iron and aluminum floc that form where groundwater seeps into Railroad Creek, as well as ferricrete which adversely impacts the stream channel substrate. The Agencies determination that iron and aluminum compounds are hazardous substances was presented by USDA (2006) based on information that Intalco presented in the DRI. Further, the commenter fails to recognize that the iron and aluminum compounds are accompanied by other hazardous substances. As discussed in more detail in the ROD risk assessment, the hazardous substances at the Site individually and collectively justify the components of the Selected Remedy.

Unique comment(s) addressed:
TGAR01-40b, TGAR01-40c, TGAR01-40d, TGAR01-40b, TGAR01-40, TARG01-40f, TARG01-40g, TGAR01-40e

Comment and Response: 56-18

Comment:
Agencies have not sought to involve all PRPs.

Response:
Comment noted for future reference. The possibility that another entity may be responsible for particular response costs is not relevant to selecting an appropriate remedy.

Unique comment(s) addressed:
TGAR01-16

Comment and Response: 56-19

Comment:
There are no significant differences in the alternatives' ability to satisfy surface water standards in Railroad Creek. See the South Bank Analysis Intalco accomplished at Agencies' request.

Response:
The Agencies disagree with the comment that there are no significant differences in the alternatives' ability to satisfy surface water standards in Railroad Creek. The South Bank Analysis was significantly flawed, as discussed in the SFS. The Agencies understand Intalco's premise. However, the referenced loading analysis assumed a mixed condition in the stream channel and does not reflect the concentration at the point of compliance for groundwater protection of surface water.

At the Holden Mine Site, as established in the ROD, cleanup levels must be achieved upgradient of the saturated portion of stream bed sediments that support fish spawning and benthic macroinvertebrates to be protective of aquatic life, and not simply within the water column after dilution has occurred.

Unique comment(s) addressed:
TGAR01-28

Comment and Response: 56-20

Comment:
Trace amounts of copper, cadmium, and zinc are associated with East Area groundwater, but Intalco has shown these metals predominantly originate in the West Area.

Response:
The reference to trace amounts is misleading, since concentrations of copper, cadmium, and zinc below Tailings Piles 2 and 3 seasonally exceed levels that are protective of aquatic life by two to three orders of magnitude (see Figure 8 in the ROD). Intalco has not demonstrated that the West Area is a source of metals below Tailings Piles 2 and 3. Intalco's flow net analysis and subsequent groundwater modeling do not show the transport of hazardous substances from the West Area of the Site to the East Area (i.e. below Tailings Piles 2 and 3). Tailings Piles 2 and 3 are the likely sources of the hazardous substances in the underlying groundwater.

Unique comment(s) addressed:
TGAR01-40a

Comment and Response: 56-21

Comment:
The remedy should be sustainable.

Response:
The Agencies did consider sustainability in comparing remedial alternatives, e.g., through consideration of permanence and long-term effectiveness, as well as other "green remediation criteria" that are listed in Table 22 of the ROD. The Selected Remedy will be more protective and more sustainable than other alternatives that do not fully clean up the Site (e.g., Alternative 13M), or which would accomplish cleanup with larger potential adverse impacts (e.g., Alternative 11M).

Unique comment(s) addressed:
INTA01-63

Comment and Response: 56-22

Comment:
A complete evaluation of a 2-foot-thick tailings and waste rock cap should take into account the need to transport soils and other materials.

Response:
The tailings and waste rock piles are currently releasing hazardous substances above state and federal cleanup levels. The Selected Remedy includes capping to protect human health and the environment.

The final Feasibility Study uses the 2-foot-thick cap for cost estimating purposes and specifies performance requirements for capping the tailings and waste rock piles, which are derived from ARARs. The ROD provides for a remedial design process to show that the cap will satisfy these performance requirements as part of the Selected Remedy. The design process will determine appropriate cap thickness, material, and material-source alternative specifications.

Unique comment(s) addressed:
TGAR01-55b

Comment and Response: 56-23

Comment:
Installation of the Phase 2 barrier wall will have negative impacts including risk of spills and accidents during shipment of fuel and lime.

Response:
The comment is correct, but the risks posed by the second phase are comparable to the risks of the first phase of construction, and Intalco's first phase experience will help mitigate risks of the later construction.

Unique comment(s) addressed:
GAR01-55a

Comment and Response: 56-24

Comment:
The Proposed Plan should have referred to a clear and consistent lack of community acceptance for Alternative 11M.

Response:
The Agencies' understand that the Holden Village community did not prefer Alternative 11M. However, Alternative 14, and not Alternative 11M, was the Agencies' Preferred Alternative in the Proposed Plan and is now the basis for the Selected Remedy.

Unique comment(s) addressed:
HVWC02-10

Comment and Response: 56-25

Comment:
With respect to groundwater collection and treatment, the Agencies do not yet know whether Alternative 13M would meet ARARs or whether additional remedy components (the additional cutoff wall) are necessary. So as with the AKART requirement, the Agencies' conclusion that Alternative 13M should be rejected as not meeting threshold requirements seems at best premature.

The Proposed Plan's conclusion that Alternative 13M omits necessary remedy components and does not meet ARARs seems directly contradicted by the Plan's recognition that the additional cutoff wall may not be necessary.

Response:
The final Feasibility Study clearly shows that Alternative 13M would not satisfy all ARARS or be protective of human health and the environment. The Proposed Plan did not say the second phase groundwater barrier wall may not be necessary. The Feasibility Study showed that it is needed to, among other reasons, protect Railroad Creek, and the 5-year break in construction is intended to reduce potential adverse construction impacts on Holden Village.

Intalco maintains that the Phase 2 barrier is not needed, but to date has not been able to demonstrate this. The containment represented by the Phase 2 barrier could be modified through a ROD Amendment if Intalco provides new information that shows the remedy will be protective and will satisfy ARARs if the Phase 2 containment is modified or omitted. The omission of a Phase 2 barrier is unlikely given the current data. Without containment, there can be no WMA, and MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3, or there would need to be an ARAR waiver for MCLs based on technical impracticability from an engineering perspective, which, if justified, would require a ROD Amendment. Such an ARAR waiver would not be approved unless the remedy was shown to be protective, including the protection of aquatic life where groundwater discharges to surface water, and the establishment of institutional controls to prevent use of groundwater for drinking water below the tailings piles.

Unique comment(s) addressed:
HVWC02-13, HVWC02-13a

<u>Comment and Response: 56-26</u>

Comment:
Installation of the Phase 2 barrier wall will have negative impacts and would be unwarranted if Phase 1 results in meeting surface water standards but drinking water standards are not met immediately east of Tailings Pile 3. Holden Village believes that installation of the additional wall under those circumstances would be unwarranted and would result in unnecessary environmental harm to the Railroad Creek valley from both the considerable additional construction activities and long-term effects of collecting and treating additional water.

Response:
The Agencies have identified drinking water standards, along with protection of aquatic life, as a basis for cleanup of groundwater at the Site in areas that are not located within WMAs. The Agencies understand that groundwater is not currently used for drinking water by Holden Village and that Holden Village currently has no plans for using groundwater. However, the groundwater at the Site is a valued resource (and is used as a drinking water source at Lucerne) and the Agencies are obligated to carry out cleanup actions that restore contaminated groundwater to beneficial uses under both state and federal law.

Unique comment(s) addressed:
HVWC02-6b

Comment and Response: 57-1

Comment:

Intalco demonstrates in Comments on Alternative 14 that Alternative 13M remedy is preferable to the Alternative 14 remedy for Honeymoon Heights. Based on the TEE and other analyses, the Alternative 13M remedy should be selected for Honeymoon Heights.

Response:

Intalco's analysis of the TEE (ERM-West 2009a) was flawed (Forest Service 2009). Reanalysis of the data that are presented in Appendix E of the ASFS identified risks to terrestrial receptors from the Honeymoon Heights Waste Rock Piles, as summarized in Table 11 of the ROD, that Alternative 13M would not eliminate.

Unique comment(s) addressed:

ERMW03-04

Comment and Response: 57-2

Comment:

Intalco's TEE supports Intalco's proposed actions for Alternative 13M. See also Intalco's Comments Alt. 14 and Comments on Agencies' Characterization of Potential Terrestrial Ecological Risks.

Response:

Intalco's analysis of the TEE (ERM-West 2009a) was flawed as discussed in the Agencies comments (Forest Service 2009), and the reanalysis presented in Appendix E of the ASFS.

Unique comment(s) addressed:

ERMW03-07

Comment and Response: 57-3

Comment:

The Agencies state that Alternative 13M does not meet threshold criteria because it does not include active measures for soil mitigation in certain areas. Except for the Honeymoon Heights Waste Rock Piles and Downslope Area, and the LWA-East, risk is equivalent to background for soils. Risks associated with the Honeymoon Heights waste rock piles and downslope areas are unlikely per the TEE. Location of the groundwater treatment system in LWA-East will remove or cover significant portion of contaminated soils. Other options will be considered if a groundwater treatment system is not located in the LWA.

Response:

Under Alternative 13M, the risk to terrestrial receptors from materials in the Lower West Area and the Honeymoon Heights Waste Rock Piles would not be addressed, except by monitoring. Analyses by the Agencies identified these areas have unacceptable risks (hazard quotients greater than 1) for plants, macroinvertebrates, and wildlife. These risks must be addressed as part of the remedy.

Unique comment(s) addressed:

MWHA01-35

Comment and Response: 57-4

Comment:

The Agencies state that Alternative 13M does not meet threshold criteria because it does not contain groundwater emanating from Tailings Piles 2 and 3, is not AKART, and does not meet ARARs. The Agencies' evaluation is based on the premise that natural attenuation will not succeed. The commenter said he understands the Agencies have uncertainty regarding natural attenuation, but that Alternative 13M should not fail to meet criteria because of this uncertainty.

Response:

Alternative 13M was rejected because it does not satisfy the threshold criteria for selection of a final remedy under CERCLA and MTCA, and for other reasons discussed in the ROD. Alternative 13M does not contain contaminated groundwater that discharges from Tailings Pile 2 and 3 into Railroad Creek; therefore, it does not satisfy AKART under MTCA. Alternative 13M does not provide containment of contaminated groundwater to the maximum extent practicable; therefore, it does not satisfy MTCA requirements for a non-permanent groundwater action and for a remedy to rely on natural attenuation. See WAC 173-340-360(2)(c)(ii); WAC 173-340-370(7).

Unique comment(s) addressed:

MWHA01-37

Comment and Response: 57-6

Comment:

The Agencies inappropriately discounted Alternative 13M with respect to some of the primary balancing criteria based on uncertainty in performance.

Response:

As stated in Section 10.1.2 of the ROD, Alternative 13M does not meet the threshold criteria and so is not eligible for selection as a final remedy under CERCLA and MTCA. Alternative 13M was evaluated against the primary balancing criteria simply for completeness and to better compare and understand the alternatives. This evaluation was not based on uncertainty of performance, but on the absence of data to support the assertion that Alternative 13M would contain contaminated groundwater and prevent discharges from Tailings Pile 2 and 3 above cleanup levels into Railroad Creek. Intalco did not demonstrate that Alternative 13M would accomplish cleanup within a reasonable restoration time frame.

Unique comment(s) addressed:

MWHA01-40

Comment and Response: 57-7

Comment:

The Agencies state Alternative 13M does not provide short-term effectiveness due to uncertainty of protection of aquatic receptors. Alternative 14 will take ten years to meet cleanup levels throughout the plume downgradient of Tailings Pile 3. Thus, Alternatives 13M and 14 should be equally ranked with respect to short-term effectiveness.

Response:
As described in Section 10.1.2 of the ROD, Alternative 14 would delay construction of the Phase 2 groundwater barrier and collection system for five years. Following this, the time for groundwater between the barrier wall and Railroad Creek to achieve cleanup levels has not been determined, but is expected to be on the order of months or a few years at most, since the groundwater barrier wall would be located immediately adjacent to the creek. In contrast, Alternative 13M would not contain groundwater impacted by releases from Tailings Piles 2 and 3, and the Agencies expect that the adverse impacts to Railroad Creek would continue for tens if not hundreds of years. Groundwater contamination extends a considerable distance downgradient from the tailings piles, as shown on Figure 9 of the ROD. The concentration of hazardous substances in this groundwater would begin to decrease immediately following the source control (containment) provided by Alternative 14; data do not show that concentrations would decrease from the effects of Alternative 13M.

Unique comment(s) addressed:
MWHA01-41

Comment and Response: 57-8

Comment:
Alternative 13M would be much easier to implement, especially considering the material resource, construction season, and schedule limitations.

Response:
Alternative 13M may be easier to implement than the Selected Remedy; however, the Agencies rejected Alternative 13M because it does not satisfy the threshold criteria for selection of a permanent remedy under CERCLA and MTCA, and for other reasons discussed in the ROD. Ease of implementation only becomes a consideration when comparing remedial alternatives that satisfy the threshold criteria under CERCLA and MTCA.

Unique comment(s) addressed:
MWHA01-42

Comment and Response: 57-9

Comment:
The commenter states that the Agencies have rejected Alternative 13M and proposed to require the installation of a barrier wall despite the substantial likelihood that Alternative 13M or some other approach would be protective. Alternative 13M should be accepted by the ROD with the usual contingency to require additional analysis of alternatives and remedial action if cleanup goals are not met within a reasonable period of time.

Response:
Alternative 13M was rejected because it does not satisfy the threshold criteria for selection of a final remedy under CERCLA and MTCA, and for other reasons discussed in the ROD. Alternative 13M does not contain contaminated groundwater under Tailing Piles 2 and 3, nor does it prevent discharge of that groundwater into Railroad Creek; therefore, it is not protective and does not satisfy ARARs. Alternative 13M does not provide containment of contaminated groundwater to the maximum extent practicable; therefore, it does not satisfy MTCA requirements for a non-permanent

groundwater action and for a remedy to rely on natural attenuation. See WAC 173-340-360(2)(c)(ii); WAC 173-340-370(7).

Unique comment(s) addressed:
TGAR01-19

Comment and Response: 58-1

Comment:
The ROD should allow cleanup levels to be adjusted based on site-specific water-effects ratios (WERs).

The ROD should provide flexibility on site-specific water quality goals.

Response:
The ROD does say that certain site-specific water quality goals may be implemented, such as a mixing zone for the treatment system outfall, provided that AKART is satisfied. Site-specific criteria could also be developed with a WER and would require a ROD Amendment.

Unique comment(s) addressed:
INTA01-31, INTA01-04

Comment and Response: 58-2

Comment:
Hardness-dependent cleanup levels should not be fixed, but should vary based on the actual hardness of the water at the times and locations that the samples are collected (i.e., not on a single background hardness level as was done in the Proposed Plan).

Response:
Calculation of the background hardness followed the methodology described in the most recent revision of the Washington State Department of Ecology (Ecology) Water Quality Program Permit Writer's Manual (Ecology 2008a).

As allowed under ARARs, the Agencies will review and assess background hardness as more data become available.

Unique comment(s) addressed:
INTA01-32

Comment and Response: 59-1

Comment:
It is premature to select a fully penetrating barrier wall as a solution for a problem that has not yet manifested itself. The contingent barrier wall should at most be a potential contingent action.

Response:
The problem has manifested itself and containment is required. There is an ongoing release of groundwater above cleanup levels entering Railroad Creek from below Tailings Piles 2 and 3.

Figures 6 through 11 in the ROD show that groundwater below and downgradient of Tailings Piles 2 and 3 have concentrations of aluminum, cadmium, copper, iron, and zinc that exceed cleanup levels for protection of surface water by one to four orders of magnitude (concentrations vary depending on constituent, location, and seasonal conditions). Further, groundwater below the tailings piles exceeds MCLs. The final Feasibility Study indicates that without a groundwater barrier and collection system, this groundwater would continue to degrade water quality and aquatic habitat in Railroad Creek for hundreds of years.

Unique comment(s) addressed:
MWHA01-11, MWHA01-13

Comment and Response: 59-2

Comment:
The ROD should provide flexibility on the Phase 2 remedy (i.e., groundwater barrier at Tailings Piles 2 and 3).

If post-implementation monitoring indicates that groundwater control is needed remedial alternatives including, but not limited to, a barrier wall should be assessed at that time.

Response:
Existing data demonstrate that groundwater above cleanup levels must be contained to protect aquatic life in Railroad Creek. Further, groundwater exceeds MCLs under and beyond Tailings Piles 2 and 3. The Phase 2 groundwater barrier is necessary to contain groundwater impacted by releases from Tailings Piles 2 and 3 to protect receptors in Railroad Creek. Further, containment is required to establish a WMA.

A possible determination of whether the Phase 2 groundwater barrier wall may be modified or eliminated could be based on evaluation of the results achieved following the implementation of first phase of the remedy, as described in Section 4.3 of the ROD.

Unique comment(s) addressed:
INTA01-01, INTA01-11

Comment and Response: 59-3

Comment:
Intalco agrees with language on p. 51 of the Proposed Plan that says "...barrier wall may not need to be constructed, or the design could be modified if Intalco can demonstrate... that monitoring data show a sustainable trend that would protect aquatic life and comply with ARARs without the barrier wall...," and suggests that this language be incorporated on page 69 of the Proposed Plan that (the comment says) require all ARARS to be satisfied three years after the remedy is implemented.

Response:
The Agencies used consistent language in both of the sections of the Proposed Plan noted in the comment. The second phase of remedy construction will not need to be installed or its design could be modified if demonstrated to satisfy ARARs and be protective within a timeframe

comparable to the Selected Remedy. The second phase of the remedy would not need to be installed only if it can be demonstrated to the Agencies' satisfaction that:

1.) Groundwater concentrations are reduced to achieve surface water cleanup levels before that portion of the hypoheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates; and
2.) One of the following: a) groundwater meets MCLs below Tailings Piles 2 and 3, as well as throughout the plume; or b) groundwater that exceeds drinking water standards will be contained within a WMA; or c) an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective is justified.

Unique comment(s) addressed:
INTA01-15

Comment and Response: 60-1

Comment:
Several comments indicated that there needs to be flexibility to allow for optimization of approaches (e.g., creek relocation and tailings stabilization) and means and methods to achieve the desired remedial action objective. These comments urged Agencies to maintain flexible language regarding design (e.g., relocated creek liner) when preparing the ROD.

Response:
The ROD provides a description of the remedial components of the Selected Remedy. Final design and construction details will be prepared during the remedial design phase(s) of remedy implementation. The final designs and construction detail will be reviewed and approved by the Agencies.

The extent of stream relocation will be determined during Remedial Design; since it affects the extent of tailings regrading that will be required to assure the creek is protected from instability of the tailings pile slopes, and to enable construction of the groundwater barrier and collection system.

Unique comment(s) addressed:
MWHA01-47, MWHA01-44, INTA01-27

Comment and Response: 60-2

Comment:
The Alternative 14 approach to stabilizing the tailings piles has several disadvantages: risk of slope failure during construction, quantity of rock required, and relocation of Railroad Creek. These disadvantages increase costs and extend construction schedule. Intalco suggests an alternative approach (e.g., jet grouting) may be more beneficial. The comments suggest the ROD include language to allow flexibility in how the tailings piles will be stabilized to be determined during Remedial Design.

During Remedial Design, Intalco will review and optimize the relocation of Railroad Creek and stabilization of the tailings piles and will consider a number of new alternatives. Intalco requests that the Agencies refer to a rock buttress and shear key as only one method to be considered for stabilizing the tailings pile slopes.

Response:
Final design of tailings and waste rock pile slopes, the need for any stabilizing buttress or ground improvement, and the extent of creek relocation will be determined during Remedial Design, based on the results of approved engineering studies.

Unique comment(s) addressed:
MWHA01-45, INTA01-43

Comment and Response: 60-3

Comment:
A single treatment system may be more effective than the two proposed for Alternative 14. Location of treatment system(s) may be different than proposed in Alternative 14.

The ROD should provide flexibility on the water treatment system design, and should not prematurely specify the number, type, or location(s) of the water treatment plan(s).

Response:
Final design of the groundwater treatment system, including its location, will be determined during Remedial Design, based on the results of approved engineering studies.

Unique comment(s) addressed:
MWHA01-46, INTA01-03, INTA01-30

Comment and Response: 61-1

Comment:
The comment expressed hope the remedy proposed and the way compliance details are worked out, are done with openness to change as new thoughts, ideas, details, or other information becomes available.

Response:
As new information becomes available, the Agencies will review and evaluate the effect on implementation of the Selected Remedy.

Unique comment(s) addressed:
CHIN01-04

Comment and Response: 61-2

Comment:
Intalco requests that general language be included in the ROD to allow for a cooperative optimization of all aspects of the remedy without requiring a ROD amendment or Explanation of Significant Difference (ESD).

Response:
The ROD allows flexibility to optimize remedial component design. However, as required by law, any significant changes to the remedy described in the ROD will be documented using an ESD, or a

ROD Amendment that will be included in the Administrative Record, with notice to the public, as appropriate.

Unique comment(s) addressed:
MWHA01-48, INTA01-29

Comment and Response: 61-3

Comment:
The ROD should provide flexibility on in situ soil treatment.

Response:
In situ treatment is the preferred remedy for some areas of the Site, as discussed in the ROD and the final Feasibility Study. The ROD requires treatability studies of *in situ* soil treatment to determine the most appropriate approach and effectiveness. Refer to the ROD, Section 14 for changes to *in situ* remedy requirements, based on additional review.

Unique comment(s) addressed:
INTA01-06

Comment and Response: 61-4

Comment:
The ROD should provide flexibility on tailings and waste rock covers.

Response:
Final design of the waste rock and tailings pile caps, to be protective and satisfy ARARs, will be determined during Remedial Design, based on the results of approved engineering studies.

Unique comment(s) addressed:
INTA01-05

Comment and Response: 62-1

Comment:
The concentrations of site-related metals in sediments would be expected to decrease in time following implementation of both Alternatives 14 or 13M. Because the Agencies have determined that cleanup actions would not be necessary based on existing conditions, and because the concentrations of COCs would be expected to decrease following implementation of Alternative 13M or 14, monitoring to determine if further actions are needed is not warranted.

Response:
The Selected Remedy includes eliminating the adverse effects of ferricrete on the aquatic environment (by relocating Railroad Creek), and removal of contaminated sediment from the wetland east of Tailings Pile 3 if a groundwater treatment facility is not built there, but otherwise does not require active measures to clean up sediment. The RI/FS showed that there have been adverse impacts to sediments in Railroad Creek and Lake Chelan but, other than elimination of ferricrete, these impacts may not require active cleanup measures beyond source controls (Forest Service 2007a). The final Feasibility Study identified source control combined with natural

geomorphic processes will likely eliminate adverse impacts to sediment in Railroad Creek once ferricrete, iron floc, and suspended solids from erosion of the tailings piles are eliminated from the creek. Although the elimination of the release of hazardous substances is expected to eliminate potential impacts to sediment in Railroad Creek and Lake Chelan, the Selected Remedy includes monitoring to confirm that risks are low and decrease over time following implementation of source controls.

Unique comment(s) addressed:
INTA01-56

Comment and Response: 62-2, 62-3

Comment:
In 1997, Railroad Creek sediments were found to cause no toxicity in tests using Hyallele azteca and Microtox. Ecology determined that those tests "tend to support the conclusion that metals concentrations in Railroad Creek sediments are not at toxic levels.

The Proposed Plan (Section 4.2.2, p. 16) states that the results of 2001 and 2002 bioassay testing on Lucerne Bar sediments "identified only minor adverse effects...." This statement is incorrect. The bioassay tests showed no adverse effects.

Monitoring of Lake Chelan sediment should not be a component of the remedy. Metals concentrations and bioassay testing of existing sediments at Lucerne Bar performed under the RI/FS clearly show that the Lake Chelan sediments do not pose a risk. Also, sampling of these sediments is time-consuming, expensive, and potentially dangerous and requires a boat and specialized sampling equipment.

Response:
The site-specific toxicity tests referred to in the comments were limited and other studies have identified adverse impacts to sediment in Railroad Creek and Lake Chelan (Ecology 1997, see also Stratus 2005). The Selected Remedy primarily relies on source controls to eliminate risk of contaminated sediment, since Railroad Creek is a fast-moving stream that has a high degree of sediment movement during seasonal high flows. Monitoring following remedy implementation will be used to confirm that risks are low and decrease over time following implementation of source controls.

Unique comment(s) addressed:
INTA01-57, INTA01-54, INTA01-55

Comment and Response: 63-1, 63-2 and 63-5

Comment:
The following comments all reference similar issues regarding the SEPA checklist:

The Environmental Checklist (EC) should disclose other environmental impacts of Alternative 14, including construction and maintenance of the barrier, larger treatment facility capacity, more sludge generation, and more lime and fuel consumption.

The checklist does not discuss the adverse environmental effects that would result from the construction of the Phase 2 barrier wall or that would be associated with a 2-foot cover on the tailings and waste rock piles. The checklist fails to address greenhouse gas emissions associated with equipment used during construction and diesel generators that may be needed on a long-term basis to power water treatment. The checklist also fails to discuss ways in which the remedy can be made less intrusive and use less energy.

Failure to disclose negative consequences of the Phase 2 barrier, and groundwater collection and treatment with the barrier in place, results in the EC underestimating the benefit of the 5-year gap between Phase 1 and Phase 2 construction.

The EC fails to discuss greenhouse gas emissions. Ecology's draft guidance document states that SEPA requires the lead agency to identify and calculate greenhouse gas emissions, associated with the project, including energy generating facilities, wastewater treatment plants, land clearing, and land use effects. GHG emissions should be calculated for Alts. 14, 11M, and 13M if 13M is accepted by the Agencies.

The SEPA checklist fails to discuss adverse environmental impacts including the Phase 2 barrier wall; the 2-foot-thick cap, greenhouse gas emissions due to trucks, other equipment, and diesel generators, or ways that the remedy can be made less intrusive and use less energy.

Response:
The final Feasibility Study provides more detail than the EC, and includes assessing the long-term versus the short-term impacts of each alternative, including consideration of potential impacts on Holden Village and the environment. Although the Selected Remedy will take longer than other alternatives to implement, the Agencies decided to implement the Selected Remedy in phases to reduce its potential adverse impacts on Holden Village.

The ROD incorporates green remediation strategies as ARARs and expresses the Agencies' preference for use of hydroelectric power for electric generation rather than petroleum-based fuels, to the extent practicable. Details of the proposed power supply systems, including planning for operations and maintenance, will be developed by Intalco under the Agencies' oversight during Remedial Design.

While it is true that construction of the Phase 2 barrier wall or a tailings and waste rock pile cover that satisfies ARARS will use more resources than would alternatives that are not as protective, the net result is a benefit to the environment. The Selected Remedy may require additional quarry and borrow materials compared to Alternative 13M (pending remedial design of the tailings and waste rock pile caps). The Selected Remedy may also involve a greater amount of fuel consumption and emissions compared to other alternatives that would not achieve as much cleanup or satisfy ARARs.

As new data are developed during the process of remedial design and remedy implementation, the Agencies will review the EC to assess any need for potential updates.

Unique comment(s) addressed:
HVWCO2-11d, INTA01-67, HVWC02-11b, HVWC02-11c, TGAR01-55c

Comment and Response: 63-3 and 63-4

Comment:
The EC creates an illusion that the Phase 2 barrier will have only positive benefits by omitting discussion of negative environmental consequences.

The EC has significant problems, such as the negative impacts of an additional cutoff wall that should be remedied prior to issuance of the ROD.

Response:
The Agencies disagree with the comment. The SEPA Checklist (located in Appendix A of the Proposed Plan) identifies potential impacts at the Site on soil, air, surface water, groundwater, endangered species, etc., which may occur from implementation of the remedy.

Existing information indicates that the Phase 2 barrier is necessary to protect receptors in Railroad Creek and to contain groundwater above MCLs in a WMA. A possible determination that the Phase 2 containment could be modified would be based on an evaluation of the results achieved following the implementation of Phase 1 remedy components, as described in Section 4.3 of the ROD.

As new data are evaluated with respect to potential Phase 2 barrier wall modifications, the Agencies will review the EC for potential updates.

Unique comment(s) addressed:
HVWC02-11, HVWC02-11a

Comment and Response: 64-1

Comment:
Do you have an approximate economic impact for expendables for this project within the valley?

Response:
The Agencies are uncertain as to the definition of "expendables" as used in this comment. The final Feasibility Study includes estimates of the costs to implement different remedial alternatives, and the estimated cost for the Selected Remedy is summarized in the ROD. To the extent the comment refers to indirect economic impacts, such as benefits and burdens to Holden Village resulting from the cleanup, the final Feasibility Study does not quantify these impacts. For example, Holden Village may lose income during the loss of regular visitors, but this loss may be offset through services Holden Village may provide to Intalco and its cleanup contractor. While the relative amounts of these and other impacts are difficult to predict, the Agencies believe it is in the interest of the Agencies, Intalco, and Holden Village to coordinate planning and operations to effectively use available resources.

Unique comment(s) addressed:
CPQA01-01

Comment and Response: 64-2

Comment:
Operators of the Lady of the Lake (the Lake Chelan Boat Company) state that Holden Village represents 25% of the traffic on board the regulated public transportation service that they operate. With the closure of Holden Village and the loss of those passengers, the service would not be able to offer the same schedule and rates as it currently does, during the period that the closure is in effect. If crews working at the Site during remedy implementation use the service, this may help replace the passengers that would have been guests of Holden Village.

The commenter also states that the potential changes to the rates and schedule could also impact the economy of Stehekin.

Response:
Holden Village has not announced plans to close during remedy construction. Both Intalco and the Agencies are sensitive to the potential impacts of remedy construction on the local economy and will work to mitigate adverse impacts to the extent that is consistent with getting the cleanup accomplished.

Unique comment(s) addressed:
CENG01-01/02

Comment and Response: 64-3

Comment:
For those accessing Holden Village from Lake Chelan, the dock has to be accessible to the boat company at each end. The commenter is concerned that the remedial actions and associated construction may upset the boat company's operations.

Response:
Remedy construction will not preclude regularly scheduled use by the boat company.

Unique comment(s) addressed:
RGID01-07

Comment and Response: 64-4

Comment:
The commenter works for the National Park Service in Stehekin, and they have a number of road and facility construction projects on the same timeline. For the construction work, it seems like there is going to be a premium for resources with bringing in and out equipment, labor, and materials. The commenter would like to get an idea of the amount of resources that are going to be used for transporting things up and down lake and if there is an opportunity for collaboration or if there will be conflict with only a few resources, barges, for transportation. Are there any ideas of estimates?

Response:
Intalco has stated that they were willing to talk with the Park Service and others to coordinate their construction so as to avoid or minimize adverse impacts to others.

Unique comment(s) addressed:
WPQA01-14

Comment and Response: 64-5

Comment:
The commenter would like the Agencies to consider the potential short-term impacts for hikers and other users going into Glacier Peak Wilderness. Holden is one of the major entry points into Glacier Peak.

Response:
The Forest Service may require temporary closure of some trails and other areas of the Site for safety reasons during remedy construction. The Agencies will work with Intalco to minimize interruptions to use of public facilities, and to communicate the extent, timing, and need for such interruptions to the public. The ROD does not include any action in the Wilderness, although access to the Glacier Peak Wilderness through Railroad Creek valley will likely be limited during heavy construction. Operations will include best management practices, such as dust suppression, that might otherwise adversely impact the Wilderness.

Unique comment(s) addressed:
BSAK01-01

Comment and Response: 65 - 1

Comment:
The greatest risk to aquatic organisms downstream from the tailings piles is iron floc/ferricrete.

Response:
Although iron floc and ferricrete are harmful to aquatic organisms, other hazardous substances are also present in Railroad Creek from release from the mine at concentrations that are toxic to aquatic life. Hazard quotient (HQ) and hazard index (HI) scores greater than 1 (indicating toxicity to organisms) were detected for acute and chronic aquatic life criteria for cadmium, copper, and zinc at every monitoring location for approximately 10 miles downstream of the mine.

Unique comment(s) addressed:
HVWC03-01

Comment and Response: 65 - 2

Comment:
The Agencies' comments (Forest Service 2010b) appear to assume Tailings Piles 2 and 3 are the only sources impacting RRC water quality. Intalco's analysis demonstrates immediate and substantial decrease in COPC concentrations in surface water would be realized under Alternative 13M. The comment estimates that it will be 10 years until maximum benefit observed in groundwater east of Tailings Pile 3, but that compliance with ARARs could occur sooner.

Response:
As described in the Proposed Plan and the ROD many sources of hazardous substances in groundwater that enters Railroad Creek will be addressed in addition to groundwater from Tailings Piles 2 and 3. Under the Selected Remedy groundwater would be collected and treated from the Main Portal (1500 Level) drainage, from contaminated seeps (SP-12 and SP-23) downslope of Honeymoon Heights, and from the LWA and Tailings Pile 1 WMAs. Tailings Piles 2 and 3 are a significant source of hazardous substances released into groundwater that later enters Railroad Creek, including aluminum, cadmium, copper, iron, lead, and zinc. These sources (Tailings Piles 2 and 3) will be contained, and the associated impacted groundwater will be collected and treated, as part of the second phase of remedy implementation.

Unique comment(s) addressed:
URSC07-07

Comment and Response: 65 - 3

Comment:
The Agencies overestimate risk to aquatic life in Railroad Creek because they do not consider site-specific conditions, including: a) NRWQC values based on sensitive species not present in Railroad Creek; b) use of excessively low hardness; c) their assumption of size of aluminum and iron floc is unrealistically small.

Response:
The Agencies disagree. The NRWQC use data for surrogate species to assure protection of species for which Site-specific data are not available. Further, the State of Washington ARARs, including its anti-degradation provision, apply where the state standards are more stringent than federal criteria. Consistent with state and federal law, Intalco has been given the opportunity, and may yet develop, Site-specific criteria for protection of aquatic life using, for example, a Water Effects Ratio study.

The Agencies' decision to use a hardness value of 7 mg/L (expressed as $CaCO_3$) was derived following methodology described in the most recent revision of the Washington State Department of Ecology (Ecology) Water Quality Program Permit Writer's Manual (Ecology 2008a). According to Appendix 6, Section 1.1.10 of the Permit Writer's Manual, background hardness is to be based on reasonable worst-case conditions. These conditions may be defined as either: a) the10th percentile value of ambient monitoring data collected during the critical season; or b) the 5th percentile value of data collected from all seasons. The Manual also states that for small data sets (fewer than 20 observations), the percentile values are to be estimated following the statistical methods of Gilbert (1987). As allowed under ARARs, the Agencies will review and assess background hardness as more data become available.

With respect to the last part of the comment, the Agencies note that studies cited in the RI/FS suggest that small monomeric aluminum (Al) species can disrupt normal ion pumping by binding to ion-regulating proteins in fish gills. The larger polymeric Al species are hypothesized to precipitate out on fish gill surfaces leading to asphyxiation (Gensemer and Playle, 1999). It is very difficult to identify which Al forms lead to mortality, as both may be present simultaneously in Railroad Creek. Thus, it is appropriate to consider all size fractions.

Regarding small and large forms of iron floc, the Agencies note Intalco's contention that dissolved iron concentrations in Railroad Creek are equal to or less than those levels determined as toxic to fish. However, measurements at seeps and the portal effluence have shown very high iron concentrations, which may lead to oxidation and precipitation events lasting hours and, therefore, impact Railroad Creek for many miles downstream.

Unique comment(s) addressed:
SHAN01-01

Comment and Response: 65 - 4

Comment:
Hazard Quotients should be based on comparison to EPA NRWQC, not to State of Washington standards because the former are based on more up-to-date toxicity information.

Response:
The Agencies referred to both state and federal standards when assessing the risk to aquatic life (expressed as a hazard quotient, which is the ratio of the exposure dose to a reference dose for a specific hazardous substance). The Agencies referred to both the NRWQC and Washington standards in selection of cleanup levels. Use of Washington State criteria is necessary except where federal criteria are more stringent or where site-specific criteria have been established. Further, where the Washington State water quality standards are more stringent than the EPA criteria they are relevant and appropriate requirements under CERCLA. 42 U.S.C. § 9621(d)(2)(A)(ii).

Unique comment(s) addressed:
SHAN01-02

Comment and Response: 65 - 5

Comment:
The Agencies' use of a background hardness value of 7 mg/L is inappropriate for calculation of risk (HQs) because: a) it is based on a woefully small background dataset; b) it includes RC-11 (which is not representative because it is upstream of three tributaries); and c) it is based on a skewed dataset that includes few sampling years (most from 1997).

Response:
Intalco has had ample opportunity and continues to have the opportunity to collect additional background data. The Agencies' use of a hardness value of 7 mg/L (expressed as $CaCO_3$) was derived following the methodology described in the most recent revision of the Washington State Department of Ecology (Ecology) Water Quality Program Permit Writer's Manual (Ecology 2008a). According to Appendix 6, Section 1.1.10 of the Permit Writer's Manual, background hardness is to be based on reasonable worst-case conditions. These conditions may be defined as either: a) the10th percentile value of ambient monitoring data collected during the critical season; or b) the 5th percentile value of data collected from all seasons. The Manual also states that for small data sets (fewer than 20 observations), the percentile values are to be estimated following the statistical methods of Gilbert (1987).

Unique comment(s) addressed:
SHAN01-03 and SHAN01-04

Comment and Response: 65 - 6

Comment:
The Agencies calculate HQs for aluminum and iron in surface water based on total concentrations of these metals. This leads to an over-estimate of risk because not all of the iron and aluminum is present in the most toxic form.

Response:
Cleanup levels for surface water were based on risk-based, chemical-specific ARARs which, for aluminum and iron, are based on total concentrations.

Unique comment(s) addressed:
SHAN01-06

Comment and Response: 65 - 7

Comment:
Based on surface water concentration predictions for copper, zinc, cadmium, iron, and aluminum for Alternatives 11, 13, and 13M derived from URS' DFFS/2010 loading analyses, reasonable estimates of hardness (12-15 mg/L), and chronic NRWQC values recalculated to account for sensitive receptors that are not present in Railroad Creek, both Alternative 13M and 14 would be protective of aquatic life in the short- and long-term.

Response:
The assertions in this comment are incorrect because: a) Intalco's loading analysis is flawed as discussed in Appendix A of the SFS (Forest Service 2007); b) the estimate of hardness used by the Agencies is 7 mg/L (CaCO3 equivalent) and was derived following methodology described in the most recent revision of the Washington State Department of Ecology Water Quality Program Permit Writer's Manual (Ecology 2008). Intalco's assertion that a hardness value of (12 to 15 mg/L) is "reasonable" is unsupported by data presented in the RI/FS; and c) Intalco's recalculation of chronic NRWQC values "for sensitive receptors not found in Railroad Creek" is an invalid application of the NRWQC. The NRWQC uses species with available toxicology data as surrogates for species for which toxicology data are not available. EPA uses this approach to assure protection of aquatic life for which toxicity data are not available. If Intalco wishes to develop site-specific water quality criteria, it needs to consider established approaches, such as a Water Effects Ratio. NRWQC modification as proposed is inappropriate.

Unique comment(s) addressed:
SHAN01-07 and SHAN01-08

Comment and Response: 70-1

Comment:
Intalco's draft TEE found that any one of the observed soil attributes alone could cause the limited plant communities observed on tailings and waste rock piles. Additional evaluations of selected cover configuration needs to be performed during design.

Response:
The Agencies agree that additional evaluations will need to be conducted during the remedial design phase of the project to optimize revegetation of the tailings and waste rock piles.

Unique comment(s) addressed:
ERMW07-22

Comment and Response: 70-2

Comment:
Intalco responded to an Agency comment on the Draft Alternative 13M Evaluation Report that requested clarification on whether the current recreational use of part of the Ballfield Area was used in the TEE as a factor that might have reduced the calculated ecological risk. Intalco's response noted that the TEE did not do this but evaluated this area of interest (AOI) in the same manner as the other AOIs.

Response:
The Agencies agree that the approach adopted for the Ballfield Area by the TEE was appropriate.

Unique comment(s) addressed:
ERMW03-13

Comment and Response: 70-3

Comment:
This comment described the developed nature of Holden Village and concluded that Holden Village is unlikely to support native wildlife populations.

Response:
The Agencies note that Holden Village is a very small developed area surrounded by a much larger undeveloped area in the National Forest. Even developed areas provide habitat for wildlife, and the amount of development at Holden Village is minimal. The village provides transient habitat for deer, robins, martens, an occasional bear, and likely many other species; and also likely provides permanent habitat for ground squirrels. As such, the ecological hazard evaluation and cleanup for Holden Village must be protective of wildlife using the area.

Unique comment(s) addressed:
ERMW03-11

Comment and Response: 70-4

Comment:
Comment noted (Agencies' comment states that the fourth paragraph, page 31, Section 1.8.2, of Intalco's Alternative 13M Evaluation Report be modified as follows: "In March 2008, the Agencies' and Intalco agreed that Intalco would update the ERA to address the current MTCA regulations and to include a broader list of COPCs and soil AOIs.").

Response:
Thank you for your comment. The comment does not affect selection of a remedy.

Unique comment(s) addressed:
ERMW03-10

Comment and Response: 70-5

Comment:
One comment said "Comment noted" in responding to the Agencies' prior comment on the Draft Alternative 13M report that stated that the TEE Summary document by ERM (Jan. 2010), is a summary of the draft TEE (ERM 2008, 2009a), and the two alternative TRV memos (ERM 2008, 2009c).

Response:
As noted in the subject Agency comment, Agency comments on all previous TEE documents issued by Intalco also are applicable to the TEE Summary report (ERM 2010a), since this document does not present any new information, and does not address previous Agency comments on the draft TEE or related Intalco documents that were previously submitted.

The comment does not affect selection of a remedy.

Unique comment(s) addressed:
ERMW08-01

Comment and Response: 70-6

Comment:
One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) and Intalco's TEE. The comment indicated the Agencies' evaluation does not evaluate risks due to ingestion of food and cannot demonstrate foraging risk to wildlife.

Response:
The Agencies did evaluate the food ingestion exposure pathway for wildlife in the evaluation of ecological risks and cleanup levels provided in the Proposed Plan (see Attachment 4 of the ASFS, Forest Service 2010a). Wildlife hazard quotients shown in Table 14 of the Proposed Plan are based on cumulative exposure from ingestion of food (i.e., plants and soil invertebrates) and incidental ingestion of soil.

Unique comment(s) addressed:
ERMW07-14

Comment and Response: 70-7

Comment:
One comment was received in response to the Agencies' prior comments on TRV1 - TRV8 (Forest Service 2010b) for the Alternative 13M report (ERM and URS 2009). The comment said that Intalco respectfully declines to provide a specific response to Agencies' Comments at this time, but reserves the right to respond in the future when fundamental differences are resolved.

Response:
Comment noted.

Unique comment(s) addressed:
ERMW06-01

Comment and Response: 70-9 and 70-13

Comment:
The Agencies have overestimated risks to terrestrial ecological receptors reported in Table 14 of the Proposed Plan because they: a) used inappropriate methods to calculate ecological indicator soil concentrations (EISCs) including toxicity reference values (TRVs), area use factors (AUFs), and bioaccumulation factors (BAFs), b) selected the lowest wildlife EISC which precludes a comprehensive evaluation of remedy components, c) used simplified hazard quotients (HQs) which overestimate risks and limit remedy evaluation, and d) did not evaluate uncertainties or consider all lines of evidence.

Response:
Table 14 in the Proposed Plan presents the results of the Agencies' evaluation of site ecological risks that was presented in the final Feasibility Study (see Appendix E and supporting discussion in the ASFS (Forest Service 2010a). This evaluation was needed to support remedial decision making because Intalco had not issued a revised TEE Report that addressed Agency comments and not provided any new information that would change results of the Draft TEE Report (ERM 2009a).

The Agencies' methods are appropriate since they are consistent with MTCA's requirements to calculate EISCs for terrestrial ecological receptors.

- **TRVs.** EISCs for wildlife were calculated using MTCA default TRVs (for the shrew, vole, and robin) and TRVs obtained from EPA's Eco-SSL documents (for the grouse, hare, and deer). Intalco used MTCA TRVs for all wildlife receptors in the Draft TEE Report. Intalco objected to the Agencies' use of EPA's TRVs; however, EPA's TRVs were used because: 1) they are based on more recent and comprehensive toxicological data, 2) because Ecology is likely to incorporate EPA's Eco-SSLs into the future rule, and 3) they were derived in a manner consistent with MTCA. MTCA indicates that literature-based TRVs represent the lowest relevant LAOEL. While EPA's Eco-SSL TRVs are NOAELs, these TRVs are often higher than some LOAELs presented in the toxicity databases and selected in a manner consistent with MTCA (EPA's TRVs are often the highest bounded NOAEL below the lowest bounded LOAEL).

- **AUFs.** The default MTCA formula for calculating EISCs for wildlife does not include an AUF and the Agencies assumed an AUF of 1 for all surrogate species. The Agencies advised Intalco of this requirement during scoping the TEE, but Intalco chose to ignore it. For the Holden Site, this default will not affect EISCs for surrogate species with small home ranges, which are the source of most of the lowest wildlife EISCs. Furthermore, the Agencies incorporated MTCA default factors for the proportion of food from the Site into their EISC calculations for the shrew and robin, which results in increasing the EISCs for these species by a factor of 2.

- **BAFs.** Consistent with MTCA, the Agencies calculated EISCs using site-specific BAFs when available. The comment noted that use of BAFs over-estimates tissue concentrations compared to the measured tissue concentrations. This over-estimation was demonstrated by comparing modeled tissue concentrations derived using BAFs to measured tissue concentrations. However, the methods used by the comment writer to make this comparison were faulty. The modeled tissue concentrations were calculated by multiplying the soil exposure point concentration (EPC) by the BAF, while the measured tissue concentrations were calculated as the reasonable maximum measured tissue EPC. As an example, application of the comment writer's methodology resulted in invertebrate EPCs for zinc at the LWA-E of 35,078 mg/kg for modeled versus 692 mg/kg for measured. This approach ignores the contribution of the measured soil concentrations at the locations where the tissue samples were actually collected. A more appropriate method of comparison is to calculate the modeled tissue concentration by multiplying the soil concentration at each tissue sample location by the BAF and then calculating an EPC tissue concentration. This method produced a modeled EPC (995 mg/kg) that is much more comparable to the measured EPC (692 mg/kg).

The comment writer also noted that use of BAFs assumes a linear relationship between soil concentration and tissue concentration, and that recent research indicates this is not always the case. The Agencies acknowledge that bioaccumulation does not always vary linearly with exposure. However, available Site data were deemed to be too limited to develop meaningful regression relationships. This assumption is supported by Intalco's own analysis presented in the Draft TEE Report (Appendix D) which shows that very few bioaccumulation regression models derived using Site data were adequate predictors of bioaccumulation.

The purpose of Table 14 of the Proposed Plan is to demonstrate an ecological risk-based need for remedial action. The analysis used to develop Table 14 is not intended to be a risk assessment and does not contain many elements of a risk assessment (e.g., problem formulation, toxicity assessment, exposure assessment, or uncertainty analysis). The use of HQ values is adequate to support remedy selection and is consistent with the risk analysis presented in the RI.

The Agencies' comments on the Draft TEE Report, which are part of the final Feasibility Study did, in fact, address the applicability of several alternative lines of evidence to remedial decision making (Forest Service 2009).

Unique comment(s) addressed:
ERMW02-01, ERMW02-02, ERMW03-05, ERMW07-12, ERMW03-09, ERMW03-19, ERMW03-06

Comment and Response: 70-10

Comment:
Based on the Agencies' and Intalco's TEEs, no potential ecological risk is identified in the Ballfield area.

Response:
The analyses presented in the final Feasibility Study identified copper as having a hazard quotient greater than 1 for soil invertebrates in the Ballfield Area (see Table 14 of the Proposed Plan, Forest Service 2010c). This determination was made by deriving a site-specific soil invertebrate EISC (45.3

mg Cu/kg soil) and comparing it to the RME soil concentration (72 mg Cu/kg soil). Supplemental analysis performed by the Agencies showed the RME soil invertebrate tissue concentration (165 mg/kg) for the Ballfield Area exceeds the alternative soil invertebrate tissue-based TRV (40 mg/kg) as well as the mixed-conifer background invertebrate tissue concentration (24 mg/kg). This supplemental analysis confirms the conclusion that copper at the Ballfield Area poses a hazard to soil invertebrates. The Preferred Alternative described in the Proposed Plan included removal of soil above cleanup levels in the Ballfield Area, along with the possible use of *in situ* treatment if soil impacted by hazardous substances is identified by further characterization to extend into adjacent undisturbed areas of late succession riparian habitat. Soil data collected from the Ballfield Area indicates that the highest copper concentrations are associated with two samples collected during the RI (Draft RI Report, Dames & Moore 1999). The RI indicated that these samples were associated with an old roadbed that may have been built using waste rock. This suggests that impacts from copper may be localized and not distributed across the entire area. Without these two RI samples, the RME soil concentration for copper at the Ballfield Area is 49 mg/kg and equates to a HQ of 1 (rounded to one significant figure). However, the data collected to date are not sufficient to characterize the extent of hazardous substances in the Ballfield Area, and characterization will need to be completed during Remedial Design or remedial action, as specified in the ROD.

Unique comment(s) addressed:
ERMW03-12, ERMW03-17, ERMW03-23

Comment and Response: 70-11

Comment:
One comment writer asserted that Intalco strongly disagrees with using cleanup levels (CULs) back-calculated from ecological indicator soil concentrations (EISCs) as the sole criteria for remedial action decision making. The comment said that decisions should be based on a weight-of-evidence approach incorporating calculated hazard quotients HQs/EISCs and other empirical site data. The comment said the Agencies approach that relies solely on HQs is inconsistent with standard TEE practice and MTCA, which endorses the use of a weight of evidence approach for assessing potential risk [WAC 173-340-7493(3)(f)]. Finally, the comment noted that "Intalco respectfully declines to provide a specific response at this time on the Agencies' cleanup levels, but reserves the right to respond in the future once there is concurrence on evaluations of risk at AOIs."

Response:
The approach used by the Agencies to develop soil CULs presented in the final Feasibility Study as summarized in the Proposed Plan and the ROD is consistent with MTCA (WAC 173-340-7493(3). This includes six alternative approaches to selection of terrestrial ecological evaluation methods, including the "weight of evidence" method cited in the comment [WAC 173-340-7493(3)(f)]. MTCA also allows "other methods approved by the department" (of Ecology). Finally, MTCA does not express a preference but leaves the choice of approach to the discretion of the person conducting the evaluation (in this case, Ecology).

Unique comment(s) addressed:
ERMW05-01

Comment and Response: 70-12

Comment:
One comment noted that based on existing and anticipated land use, Holden Village is not intended to support native plant communities or wildlife populations, and non-native ornamental plants and soil invertebrates are not considered receptors of concern. The comment noted that, despite this, the Draft TEE Report did evaluate risks to plants, soil invertebrates, and wildlife at Holden Village.

Response:
The Agencies used the TEE data collected by Intalco to evaluate risk to terrestrial receptors that are not limited to native species, and identified HQ values greater than 1 for one or more metals for plants, soil invertebrates, and wildlife. Under MTCA, the goal of the TEE at sites that are not considered industrial or commercial properties must include protection of plants, soil invertebrates, and wildlife.

Unique comment(s) addressed:
ERMW03-22

Comment and Response: 70-14

Comment:
Attachment 2 to the document "Agencies Comments on the Draft Alternative 13M Evaluation Report and Related Documents" is incomplete because it does not include Intalco's responses to the Agencies' Comments. Intalco performed additional analyses after the draft TEE (e.g., Alternative TRVs). Intalco's draft TEE was not revised to incorporate the comments/responses or additional analyses because the Agencies did not provide comments related to these analyses until the release of the Proposed Plan.

Response:
Intalco's responses to Agency comments to the Draft TEE Report are part of the Administrative Record for the Site, and were considered by the Agency as part of the final Feasibility Study, the Proposed Plan, and the ROD.

The Agencies have determined that the existing information is sufficient for remedial decision making.

Unique comment(s) addressed:
ERMW04-01

Comment and Response: 70-15

Comment:
Intalco's current TEE (ERM 2009a, as supplemented by ERM 2009b and 2009c) supersedes ecological assessments presented in the DRI and DFFS. Intalco's current TEE corroborated many of previous findings. See also Intalco's Comments on the Agencies' Characterization of Potential Terrestrial Ecological Risks presented in the Proposed Plan.

Response:
The Agencies understand that the Draft TEE report (and supplements) and Agency comments to the Draft TEE provide additional information not presented in the ecological assessments in the DRI and DFFS. These documents are all part of the Administrative Record for the Site, and were considered by the Agency as part of comparing alternatives as discussed in the final Feasibility Study, the Proposed Plan, and the ROD.

Unique comment(s) addressed:
ERMW03-09

Comment and Response: 70-16

Comment:
Intalco's draft TEE and subsequent analyses did not identify potential risks to wildlife at the tailings piles or east and west Waste Rock Piles compared to background. Some hazard quotients (HQs) exceed 1 for plants and soil invertebrates, but these were based on literature values for biota not observed at the Site and associated uncertainty. Soil attributes alone are considered sufficient to explain observed effects on plant and soil invertebrate communities.

Response:
The Agencies identified risks to wildlife from elevated concentrations of cadmium, copper, thallium, and zinc, in the tailings piles and elevated concentrations of lead, molybdenum, thallium, and zinc in the main east and west Waste Rock Piles and waste rock, as noted in Table 14 of the Proposed Plan. These evaluations included comparisons to site-specific EISCs and soil background. Differences in risk estimates between the Agencies and Intalco's Draft TEE Report are primarily the results of differences in methodology. For example:

1. For the tailings piles, Intalco estimated wildlife exposure to soil-borne chemicals in the 0 to 1 foot and 0 to 6 foot strata separately for each of the three tailings piles, while the Agencies estimated soil exposure by pooling all soil data from the three tailings piles from all depths. The Agencies approach is based on there being a similar source of contamination at the three tailings piles and the fact that during remediation the tailings will be regraded, which will result in exposure to deeper soil.
2. For the east and west Waste Rock Piles, Intalco's wildlife risk estimates were based on ingestion of soil and ingestion of conifer tissue because conifers were the only biota sampled. To evaluate current and future risks at the east and west Waste Rock Piles, the Agencies used available Site-specific data (e.g., incorporation of conifer data into derivation of bioaccumulation factors) and supplemented this information with MTCA default bioaccumulation factors when Site-specific data were unavailable.

The Agencies acknowledge that current conditions on the tailings and waste rock piles (e.g., low soil nutritional levels, low soil water holding capacity) have a negative effect on plant establishment, growth, and survival. This diminished primary productivity affects the diversity and abundance of the soil invertebrate community as well as plant life. Unfortunately, the negative impacts from chemical toxicity in the tailings and waste rock cannot be readily distinguished from impacts associated with other soil characteristics. Nonetheless, analysis of chemical hazards to plants and soil invertebrates conducted by the Agencies using Intalco's data indicate that several constituents (notably copper and zinc) pose hazards to both groups of organisms.

In an attempt to improve the risk assessment for plants and soil invertebrates, the Agencies suggested in comments to the Draft TEE Report that Intalco evaluate the use of tissue-based toxicity data to help evaluate risks to plants and soil invertebrates. Intalco subsequently issued two reports proposing alternative toxicity values for plants and soil invertebrates of which many were accepted by the Agencies. This information was incorporated into hazard estimates provided in the final Feasibility Study.

While much of the literature-based toxicity information for plants and soil invertebrates is based on species that are not present at the Holden Site, this type of information is commonly used in ecological risk assessments. Risk assessments commonly use surrogate species for which toxicity data area available to assess risk to other species for which data are not available. During development of the TEE work plans, the Agencies agreed with Intalco that conducting plant and invertebrate soil toxicity tests would not be appropriate because of confounding factors associated with general soil quality. As a result, the literature-based toxicity information for plants and soil invertebrates are the primary data used by the Agencies to assess risks associated with the tailings piles and main east and west Waste Rock Piles.

Unique comment(s) addressed:
ERMW07-05, ERMW07-12

Comment and Response: 73-1

Comment:
Where will the landfills be?

Response:
The currently proposed location of the landfill for disposal of sludge from the water treatment facility would be on top of one of the tailings piles (see Table 15 of the Proposed Plan). The final location of this and other possible on-site landfill(s) will be determined during Remedial Design.

Unique comment(s) addressed:
RGID01-04

Comment and Response: 73-2

Comment:
Will the hazardous materials be shipped down lake then disposed of or will hazardous materials be disposed of at the Site?

Response:
Hazardous materials will be disposed of on the Site through a combination of consolidation, capping, and groundwater containment and treatment.

If any materials that classify as State Dangerous Waste [RCW 70.105; Chapter 173-303 WAC] are encountered, these materials will be disposed of off site, unless Intalco provides a plan that is approved by the Agencies for on-site stabilization (if required) and disposal in a permanent repository.

Unique comment(s) addressed:
CPQA01-05, HPQA01-01

Comment and Response: 74-1

Comment:
Several comments were received pertaining to the Agencies' review of Section 4.5 (Effects of Construction on Water Quality) of Intalco's February 24, 2010 Draft Hydrogeology Technical Memorandum Addendum in Context of a Contingent Remedy (URS 2010). These comments indicate that no short- or long-term spikes in contaminant loading to groundwater or surface water would be expected from regrading of the tailings pile slopes.

Response:
These comments address Agency concerns that regrading the tailings piles during Site cleanup would expose relatively unoxidized tailings and infiltration may lead to increases in contaminant loading to groundwater that discharges to Railroad Creek. The comments acknowledge that runoff or shallow interflow from fresh tailings exposed during construction could cause a short-term contaminant spike if not controlled. Construction best management practices (BMPs) will would be employed to ensure that physical and chemical water quality standards and other ARARs are met during construction.

The comments also acknowledge that oxidation of fresh tailings exposed during regrading would generate of additional contaminant mass that would migrate downward through the remaining tailings, but suggests that the tailings pile cover will be sufficient to limit infiltration of precipitation and oxygen such that no discernible "pulse" of contamination would be expected over the long term. The Agencies note that Intalco's modeling of contaminant release rates (see Appendix E of the DFFS, URS 2004) assumed the tailings pile cap would reduce infiltration into the tailings piles to 20 percent of mean annual precipitation. The Agencies will review Intalco's design of the tailings piles cover, proposed construction methods (including BMPs), and oversee the cleanup so that construction-related impacts to groundwater and surface water are minimized.

Unique comment(s) addressed:
URSC07-44, URSC07-45, URSC07-46, URSC07-47

Comment and Response: 74-2

Comment:
The disturbance of the tailings and subsurface soil that will occur as part of the remedy implementation will cause a short-term increase in shallow-groundwater concentrations that would lengthen the time needed to reach compliance with ARARs downgradient from the tailings piles.

Response:
Intalco has addressed this issue in the document titled *Response to the Agencies' Comments on the Draft Hydrogeology Technical Memorandum Addendum in Context of a Contingent Remedy*, dated February 24, 2010, prepared by URS for Intalco. Intalco concluded that because of the relatively short duration of construction, the implementation of construction BMPs, and the ability of the cover to limit infiltration of precipitation and oxygen, that "short-term perturbations to the surface

will not have discernible impact to the mass loading that is observed at depth where tailings pore water contacts groundwater."

The Agencies will review the design of the tailings piles cover, proposed construction methods (including BMPs), and oversee the cleanup to assure that construction related impacts to groundwater and surface water are minimized.

Unique comment(s) addressed:
MWHA01-16

Comment and Response: 75-1

Comment:
Railroad Creek Valley, Glacier Peak Wilderness, and surrounding mountains are important areas.

Response:
Comment noted.

Unique comment(s) addressed:
CCAR01-03, CSCH01-01, PBAN01-03

Comment and Response: 1-1

Comment:
The Agencies' proposed groundwater collection components are based on faulty regulatory assumptions that all groundwater that exceeds ARARs must be collected and treated, which led to dismissal of Alternative 9 even though Intalco showed potential ARARs would be met within a reasonable time.

Response:
CERCLA and the NCP require restoration of groundwater to its beneficial uses, i.e., for this Site, achieve MCLs throughout the plume, within a reasonable time frame whenever practicable. When restoration of groundwater is not practicable, it is necessary to prevent further migration of the plume and to prevent exposure to the contaminated groundwater [42 U.S.C. § 9621(d)(2)(A); 40 C.F.R. § 300.430(a)(1)(iii)(F)]. So long as the contaminated groundwater is managed in a WMA, MCLs may be met at and beyond the edge of the WMA. MTCA has similar requirements. See, e.g., WAC 173-340-360(2)(c)(ii)(B). Alternative 9 did not provide for treatment or containment of all groundwater above cleanup levels, and Intalco did not show that groundwater would achieve ARARs within less than hundreds of years, certainly not within a reasonable restoration time frame.

Unique comment(s) addressed:
TGAR01-17a, TGAR01-17b

Comment and Response: 3-1, 46-6, 47-1 and 57-5

Comment:
Alternative 13M will likely achieve proposed ARARs through monitored natural attenuation (MNA), and Intalco has shown that MNA is occurring at Holden.

The Agencies mistakenly conclude a remedy is not AKART unless it is more active than MNA. The Agencies state Alternative 13M does not satisfy AKART because natural attenuation has not been demonstrated. Therefore, the Agencies conclude natural attenuation is not a suitable alternative to physical containment or hydraulic isolation of groundwater.

MNA is an active remedy under MTCA. Natural attenuation in conjunction with source control measures should be treated as a viable technology for meeting cleanup goals in a reasonable restoration time frame. Agencies acknowledge all remedies rely on natural attenuation. Thus, Phase 1 of Alternative 14 and Alternative 13M should be considered to satisfy AKART.

Alternative 13M satisfies MTCA's preferences for containment of contaminated groundwater, active measures, and source control, to the maximum extent practicable before relying on MNA.

Alternative 13M contains primary sources of contamination and does not rely primarily on dilution and dispersion. Alternative 13M uses source control to the maximum extent practicable. Alternative 13M does not rely solely on MNA. The contaminants remaining on site will not pose an unacceptable threat to human health and the environment.

Response:
Monitored natural attenuation is an acceptable remedy component under both CERCLA and MTCA. However, Intalco has not demonstrated that natural attenuation would meet ARARs or eliminate risks to aquatic life within a reasonable restoration time frame. Phase 1 of Alternative 14 and Alternative 13M are, alone, not AKART since they would not address the ongoing release of hazardous substances into groundwater from Tailings Piles 2 and 3. Analyses presented in the DFFS indicate that, if not remediated, this release would continue for hundreds of years. To be protective, a permanent remedy must include additional measures (e.g., the Alternative 14 Phase 2 groundwater barrier, collection, and treatment system) to eliminate the ongoing release of groundwater with concentrations that exceed levels protective of aquatic life. With that said, the ROD does provide an opportunity for Intalco to provide sufficient MNA data for further evaluation and possibly modification or elimination of the Phase 2 remedy design.

Alternative 13M does not satisfy MTCA's preferences for containment of contaminated groundwater, active measures, and source control to the maximum extent practicable before relying on MNA since Alternative 13M does not include containment of groundwater impacted by releases from Tailings Piles 2 and 3. The final Feasibility Study shows that a groundwater barrier wall around Tailings Piles 2 and 3 is well within conventional construction means and methods, and, therefore, it is practicable (see Appendix C of the SFS).

Figures 6 through 11 in the ROD show that groundwater below and downgradient of Tailings Piles 2 and 3 have concentrations of aluminum, cadmium, copper, iron, and zinc that exceed cleanup levels for protection of surface water by one to four orders of magnitude (concentrations vary depending on constituent, location, and seasonal conditions). The final Feasibility Study indicates that without a groundwater barrier and collection system this groundwater would continue to degrade water quality and aquatic habitat in Railroad Creek for hundreds of years.

The Agencies agree that it is necessary to relocate Railroad Creek so that it is hydraulically isolated from groundwater adjacent to Tailings Piles 2 and 3 during the period before the Phase 2 groundwater barrier and collection system is constructed as part of the Selected Remedy, but note that this alone would not prevent release of hazardous substances from groundwater into the creek downgradient (east) of Tailings Pile 3, nor will it affect the attainment of MCLs in groundwater.

Unique comment(s) addressed:
MWHA01-27, MWHA01-38, MWHA01-39 TGAR01-38, TGAR01-07, TGAR01-35b, TGAR01-24, TGAR01-33, TGAR01-35a, URSC07-17, TGAR01-05, TGAR01-08

Comment and Response: 4-3

Comment:
AKART requires use of all practicable methods of treatment at reasonable cost.

The [Phase 2] barrier wall does not satisfy AKART because it would not provide additional environmental benefit. Intalco estimates that the wall would cost $15,730,000; this incremental additional cost is disproportionate to the expected environmental benefits.

The Agencies should consider the cost/benefit of Alternative 13M in the Proposed Plan. Intalco argues the additional $37M in Alternative 14 cost is grossly disproportionate to the negligible reduction in risk to public health and the environment that would be achieved over Alternative 13M.

Response:
Under both CERCLA and MTCA, cost is only an acceptable basis for comparing remedial alternatives that first satisfy the threshold criteria for selection of a permanent remedy. 42 U.S.C. § 9621(b)&(d); 40 C.F.R. § 300.430(f)(1)(i)(A). Under MTCA, the disproportionate cost analysis is only used to assess whether an alternative that first is determined to satisfy the threshold criteria, is permanent to the maximum degree practicable [WAC 173-340-360(2)(c)(i)]. The point of practicability comparison is to assess the cost versus benefit of competing alternatives that meet threshold criteria, not to try to compare the dollar cost of an alternative with the dollar benefit of eliminating environmental risk. In this case, data show that groundwater contaminated above cleanup levels is currently entering Railroad Creek in the area that will be contained by the Phase 2 barrier. The Agencies have no current basis on which to expect that this situation would not continue under Alternative 13M, (which does not include the Phase 2 barrier). As a result, Alternative 13M does not comply with MTCA's first two threshold criteria: it is not protective of human health *and the environment* (WAC 173-340-360(2)(a)(i)) [emphasis added], and it does not comply with cleanup standards (WAC 173-340-360(2)(a)(ii)).

The comment refers to an Intalco estimate for the Phase 2 barrier that is more than $2 million more than the estimate previously presented by Intalco (URS 2009), but provides no basis for this increase. The Agencies' estimate for construction of the groundwater barrier and collection system around Tailings Piles 2 and 3 is about $6.7 million (if it was constructed along with the barrier and collection system around the LWA and Tailings Pile 1), or about $10.2 million if it is constructed as a separate phase (including remobilization and camp costs for Phase 2). The Agencies estimate of the difference between Alternatives 13M and 14 not including contingencies, is about $27 million, not $37 million as indicated in the comment (The $37 million included in the comment inflated the cost for Alternative 14 by adding several items not included in the Proposed Plan.)

Unique comment(s) addressed:
TGAR01-38a, INTA01-17, MWHA01-43

Comment and Response: 7-1

Comment:
After the period of observation and monitoring what's going to happen? Is there going to be a long time again of disagreements or is there something already planned for the disagreements that are going to happen?

Response:
The cleanup schedule will be implemented under a Consent Decree or a Unilateral Administrative Order, both of which can be enforced through legal action if need be. The Selected Remedy allows Intalco to collect additional data by monitoring for a period of up to 3 years following completion of the first phase of the remedy. This 3-year period allows for evaluation of the new data in the fourth year to determine whether the second phase can be modified. Unless new information collected in the 3 years after the first phase clearly indicates that cleanup goals will be met within a reasonable restoration time frame, the second phase of construction will be designed in the fifth year and implemented immediately thereafter.

Unique comment(s) addressed:
MHOH01

Comment and Response: 12-4

Comment:
Groundwater cleanup standards should protect groundwater-to-surface water pathways as well. Depth and lateral extent of hyporheic zone should be determined at and near the site and treated as surface water. "Groundwater" immediately beneath creeks at site is surface water and should be regulated on that basis to the extent of contamination (i.e., at least as far as 7-mile Creek).

Response:
The Agencies agree. The Selected Remedy requires cleanup of groundwater to achieve levels that are protective of aquatic life outside of the designated WMAs. The Selected Remedy includes monitoring to assure cleanup levels are achieved in groundwater before or upgradient of the portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates, to assure protectiveness of the remedy.

Unique comment(s) addressed:
NPEC01-04

Comment and Response: 12-5

Comment:
Establishment of sediment cleanup levels is not required because the Proposed Plan states (Section 8.1.4, p. 38) that sediment cleanup in Lake Chelan or Railroad Creek is not needed.

Use of such screening-level guidance values is inappropriate because site-specific toxicity testing shows there is no risk even though screening levels are exceeded.

SL-1 values are concentrations "below which adverse effects would not be expected." Concentrations above these levels do not equate with risk.

Response:
The final Feasibility Study identified active measures are not needed to address sediment in Railroad Creek as part of initial remedy implementation, other than elimination of ferricrete from the aquatic habitat within Railroad Creek and source control related to the tailings piles. The Site-specific toxicity tests referred to in the comment were limited, and other studies have indicated there are adverse impacts to sediments in Railroad Creek and Lake Chelan (Ecology 1997, Stratus 2005). The Selected Remedy primarily relies on source controls to eliminate risk of contaminated sediments, since Railroad Creek is a fast-moving stream that has a high degree of sediment movement during seasonal high flows. Monitoring following remedy implementation will be used to confirm that risks are low and decrease over time following implementation of source controls.

Unique comment(s) addressed:
INTA01-51, INTA01-52, INTA01-53

Comment and Response: 12-6, 12-9 and 70-3

Comment:
Cleanup levels are not required for the Ballfield Area, Holden Village, Wind-Blown Tailings, or Lower West Area-West because, according to the TEE, there is no terrestrial ecological risk.

Cleanup levels for LWA-E presented in the Proposed Plan are too conservative. Intalco's TEE should be used as the basis for establishing soil cleanup levels in this area.

Response:
Intalco's analysis of the TEE (ERM-West 2009a) was flawed (Forest Service 2009), and reanalysis of the data that are presented in ASFS (Table 10 and Appendix E) identified risks to terrestrial receptors in the areas noted in the comment, as well as in other areas of the Site.

In responding to other comments on the Proposed Plan, the Agencies reassessed available information on five areas, including the Ballfield Area, Holden Village, and the Wind-Blown Tailings Area, using alternative tissue-based TRVs and/or background tissue data. This reassessment is discussed in Houkal and Dagel (2011). As discussed in the ROD, this reassessment indicated remediation was not needed for the Wind-Blown Tailings Area, but reaffirmed the need for remediation in the Ballfield Area through targeted source removal, and in Holden Village through *in situ* treatment. There was no change in the proposed cleanup for the LWA (East and West).

Unique comment(s) addressed:
INTA01-47, INTA01-50, ERMW03-12, ERMW03-17, ERMW03-23, ERMW03-21

Comment and Response: 12-7 and 12-8

Comment:
Cleanup levels are not required for the Tailings Piles, Waste Rock Piles, Lagoon, Maintenance Yard, and SRA because proposed actions will address ecological risks.

Cleanup levels are not required for Honeymoon Heights Waste Rock Piles and downslope areas because, as explained in the Proposed Plan, the areas would be cleaned up using in situ treatment or, if that is not appropriate, the cleanup levels would be waived or Ecology would not require cleanup (using SEPA substantive authority).

Response:
The commenter is correct in saying that the Selected Remedy will address ecological risks; however, there may be some misunderstanding about the purpose of setting cleanup levels.[2] Cleanup levels are always required at cleanup sites and are used to select a remedy. The process of selecting these cleanup levels is also important for understanding health risks and exposure. Cleanup levels for Holden Mine were selected after careful evaluation of Site-specific factors, toxicology information, etc.

The comment writer may consider the "proposed actions" to be elements that are common to all the remedial alternatives presented in the Proposed Plan, or may be referring only to a specific alternative, but in either case cleanup levels are needed, along with points of compliance, to determine the extent of cleanup in each of the areas referred to.

If *in situ* treatment is not effective in some areas, the Agencies may waive the cleanup level under CERCLA, and under MTCA not require additional cleanup action.

Unique comment(s) addressed:
INTA01-48, INTA01-49

Comment and Response: 12-10

Comment:
Soil cleanup levels for protection of groundwater will be evaluated during design where PCOC concentrations in groundwater exceed ARARs and are located outside/downgradient of containment.

Response:
Soil cleanup levels have already been selected and are documented in the ROD. Potential soil cleanup levels to protect groundwater were considered for all areas of the Site, in part to determine where containment is needed as part of the remedy. Under MTCA, cleanup levels are used to assess alternative cleanup technologies or combinations of cleanup technologies ("cleanup action alternatives") that may be used to comply with cleanup standards [WAC 173-340-700(4)(b)]. It is not appropriate to wait for remedial design to establish cleanup levels.

Unique comment(s) addressed:
ERMW03-08

---

[2] Cleanup levels (i.e., the concentration of a hazardous substance in soil, water, air, or sediment that is determined to be protective of human health and the environment under specified exposure conditions), in combination with points of compliance, typically define the area or volume of soil, water, air, or sediment at a site that must be addressed by the cleanup action, [WAC 173-340-700(2)].

Comment and Response: 12-11 and 43-1

Comment:
Groundwater from the LWA-E would be collected for treatment prior to discharge to Railroad Creek [under the Selected Alternative]; therefore, soil cleanup for groundwater protection is not required under MTCA.

If potential risks to human or terrestrial ecological receptors are confirmed during Remedial Design, flexibility should be allowed to identify the appropriate remedial actions to address the potential risks and which are consistent with the final land use for this AOI.

Response:
A soil cleanup standard for protection of groundwater is not required in the ROD where the groundwater is contained as part of remedy, and criteria of WAC 173-340-740(6)(f) are met, as is the case for the Selected Remedy.

Risks to humans exist for four hazardous substances (via the direct contact and ingestion pathway) and risks to terrestrial receptors exist for 12 hazardous substances in the LWA-East, see Tables 10 and 12 of the ROD. The ROD specifies the cleanup actions required in the LWA-East, which include removal, capping, or *in situ* treatment.

Unique comment(s) addressed:
ERMW03-16, ERMW01-04

Comment and Response: 12-12

Comment:
The Agencies should remain open to new information demonstrating that WQC can be adjusted upward without causing harm to aquatic life.

Response:
Thank you for your comment. The Agencies are amenable to considering adjustments to water quality criteria in accordance with CERCLA and MTCA.

Unique comment(s) addressed:
HVWC02-07

Comment and Response: 12-13

Comment:
Surface water cleanup levels for hardness-dependent COCs should not be single values, but should vary with hardness and be based on hardness measured in site water.

Response:
Hardness concentrations used for some surface water cleanup levels were developed in accordance with Ecology's Water Quality Program Permit Writer's Manual (Ecology 2008). After remedy implementation, methodology for calculating cleanup levels and protectiveness will be evaluated at the time compliance samples are collected.

Unique comment(s) addressed:
SHAN01-05

Comment and Response: 14-8

Comment:
Phase 2 barrier wall would primarily address iron and aluminum, but these are not hazardous substances.

Response:
Groundwater (including seeps) impacted by releases from Tailings Piles 2 and 3 exceed cleanup criteria for aluminum, cadmium, copper, iron, and zinc by factors ranging from one to four orders of magnitude, depending on the constituent and seasonal effects see Table 7 and Figures 8, 9, 10, and 11 in the ROD. The iron and aluminum compounds present at the Site are hazardous substances. The Agencies determination that these iron and aluminum compounds are hazardous substances was presented by USDA (2006) based on information that Intalco presented in the DRI.

Unique comment(s) addressed:
TGAR01-04

Comment and Response: 15-1

Comment:
The Agencies' cost estimates underestimate overall costs for the selected remedy since contingencies are not included.

Response:
Contingent costs were considered in different ways in the various cost estimates developed for the final Feasibility Study. Intalco proposed contingencies be addressed by adding 30 percent to the base cost estimate. This approach is likely to produce an unrealistic comparison of costs as discussed in Appendix B of the SFS, since there are differing degrees of uncertainty associated with estimating the scope and cost of different components of the remedy. For this reason, EPA guidance (EPA 2000) provides different contingency factors for different types of remedial activity, and suggests weighting factors for typical cost elements included in a proposed cleanup action. While contingencies are typically considered as an allowance for unanticipated cost increases, there is also a potential for contingent cost reductions from anticipated or unanticipated circumstances. The ASFS identified the single largest contingent cost for the Preferred Alternative would be a potential cost reduction of about ten percent ($9.6 million) if the groundwater barrier wall and collection system were eliminated from the Preferred Alternative (Alternative 14).

There is no reason to adopt Intalco's approach to applying the same contingency factor to all components of all the alternatives, since cost is not considered in selecting a remedy except as part of comparing alternatives that first have been identified as satisfying the threshold criteria under both CERCLA and MTCA, and none of Intalco's alternatives would satisfy the threshold criteria.

Application of a single contingency factor to all alternatives has the effect of increasing the apparent relative cost difference among the alternatives. Since cost is not a primary remedial alternative selection criterion under either CERCLA or MTCA, and since contingency costs do not apply uniformly to different alternatives (as discussed in Section 4.0 of Appendix B, of the Supplemental Feasibility Study), the Agencies compared costs for remedial alternatives without including contingency costs. However, if for the sake of completeness, a single 30 percent contingency factor as proposed by Intalco is applied to the Agencies' estimates for the three alternatives evaluated in the Proposed Plan (i.e., not including Alternative 12, the no-action alternative) the costs (including net present worth of future operations, maintenance, and monitoring [OMM]) would be $156 million for Alternative 11M, $103 million for Alternative 13M, and $139 million for Alternative 14.

Unique comment(s) addressed:
MWHA01-50, MWHA01-51, INTA01-68

Comment and Response: 15-2

Comment:
The comment notes that MWH's estimated costs for Alternatives 13M and 14 are $108.4 million and $146 million, respectively, and says that the difference ($37.6 million) cannot be justified for reasons noted. This estimate of Alternative 14 costs include costs for disputed components that are discussed in the comments, including the Phase 2 barrier wall ($15,730,000), an additional foot of cover ($2,158,000), in-situ lime treatment ($1,521,000), and a geomembrane liner ($11,661,000).

Response:
The comment demonstrates the problems that arise when cost figures are used loosely without careful reference to the source and consideration of what should or should not be included. The Agencies adopted Intalco's estimates for construction of the groundwater barrier wall and collection system, so it is unclear why the comment writer considered this a point of difference. Intalco included costs for components (e.g., an extra foot of soil and a geomembrane in the tailings and waste rock pile caps) that were not described by the Agencies as part of Alternative 14. Finally, the comment writer did not include any details about their concern that the Agencies' estimated cost of *in situ* treatment was incorrect. As noted in the final Feasibility Study, the cost of *in situ* treatment will need to be determined based on pilot studies during Remedial Design.

Unique comment(s) addressed:
INTA01-69

Comment and Response: 15-3

Comment:
The commenter requests that Intalco's updated cost estimates be reflected in the Proposed Plan.

Response:
The Agencies considered Intalco's cost estimates for Alternatives 11 and 13M and identified they were flawed, as discussed in Forest Service (2010a). Also, Intalco's general comments on comparing the cost of Alternatives 11 and 13M were made prior to completion of Intalco's cost estimate, and this cost estimate was simply a collection of spreadsheets that were neither clearly organized nor supported by explanatory text. Intalco provided only summary estimates for a few remedy components and no detailed cost estimates for Alternatives 11M or Alternative 14, whereas, the Agencies developed detailed cost comparison as discussed in Appendix A of the ASFS.

Unique comment(s) addressed:
MWHA01-55

Comment and Response: 15-4

Comment:
The commenter indicated that Intalco's cost estimate did not use a regional adjustment factor (Spokane) for unit costs. Intalco does not believe these adjustments are appropriate.

Response:
Intalco was able to select the method of cost estimating it deemed most appropriate, based on engineering literature and its own experience. The Agencies relied in large part on the RS Means publications for unit costs that are updated annually and do include regional correction factors for national cost indices. This adjustment was applied to all the alternatives considered; therefore, it is not a significant difference in comparing the costs among these alternatives. The Agencies believe that use of a local area correction is a well-established practice that is reflected in professional practice (e.g., Association for the Advancement of Cost Engineering) and is accepted broadly by industry. The Agencies also relied on local contractor quotes and other methods of obtaining cost data for its estimates. Finally, the Agencies note that adoption or elimination of the local correction factor for adjusting published national cost indices (about 3 percent at the time of the estimates presented in the ASFS) is not a significant factor for feasibility study estimates that are intended to have a –30 to +50 percent level of accuracy in accordance with Corps of Engineers and EPA guidance (EPA 2000).

Unique comment(s) addressed:
URSC09-01

Comment and Response: 16-1

Comment:
While all alternatives have cost risk and cost growth that may occur due to the unique constraints of Holden Mine, the large scope increase for Alternative 14 and uncertainty further magnifies these risks over Alternative 13M, especially due to the deep groundwater barrier wall at TP3.

Response:
The Holden Mine cleanup has atypical site constraints (e.g., lack of highway access) that are likely to impact the remedial alternatives considered. Nevertheless, the Selected Remedy consists of conventional technologies that have been successfully implemented for decades at other sites, including large scale earth moving and capping, closure of underground mine openings, stream diversion, groundwater barrier and collection systems, and treatment using acid neutralization and precipitation. The groundwater barrier wall that is included in the Selected Remedy is well within the depth and other factors (e.g., alluvial soil with boulders) that have routinely been addressed at other sites, as discussed in Appendix C of the SFS. The comment writer should be aware that while large scope items have the potential for increased costs and risks, they also have equal potential for reduced costs resulting from innovation during Remedial Design and better-than-anticipated site conditions during construction.

Unique comment(s) addressed:
MWHA01-52

Comment and Response: 16-2

Comment:
Alternative 14 "further aggravates" the lack of construction materials available for remedial work because it assumes various aggregate materials will come from other on-site remedial activities. These on-site material sources are unlikely to produce enough material so soil will need to be imported from off-site sources that will result in increased cost and adverse environmental impact.

An additional $1,500,000 should be added to Alternative 14 for import of cover material from Dan's Camp.

Response:
The Agencies' detailed cost estimates for Alternative 11M that formed the basis for the Alternative 14 cost estimate did consider the availability of materials produced from different parts of the remedy (e.g., slash from logging during road construction as a source of cover for revegetating the tailings and waste rock pile caps, and excavation for the treatment facility as a source of cover material for the tailings pile caps). The Agencies' estimate for production of soil and rock materials also assumed these materials would come from Dan's Camp and Lightning Ridge, respectively, which would tend to overestimate haul costs compared to production from other sources closer to the former mine. As a result, the comment about needing to add $1.5 million for production from Dan's Camp is incorrect.

The on-site material sources (i.e., within the Railroad Creek valley) will be further evaluated during Remedial Design. It is extremely unlikely that soil and rock construction materials would need to be imported from off site (e.g., outside the Railroad Creek valley). The Agencies will consider both cost and environmental impact in evaluating and approving borrow and quarry sites.

Unique comment(s) addressed:
MWHA01-53, MWHA01-54

Comment and Response: 17-1

Comment:
What percentage of money is public money and what percentage of it is being covered by the mining company?

Response:
The Agencies anticipate that Intalco will bear the cost for remedial actions, including reimbursement of Agency costs.

Unique comment(s) addressed:
HPQA01-06, PGOL01-01

Comment and Response: 17-2

Comment:
Does the mining company have money set aside to pay for short-term remedial activities and long-term operations maintenance and monitoring? Will the mine company be required to provide financial guaranties, such as bonds, to assure short- and long-term remedial actions occur in the event of insolvency?

Response:
The Agencies understand that Intalco has the financial resources to complete the cleanup. Financial guarantees are typically required as part of a Consent Decree to cover long-term costs.

Unique comment(s) addressed:
MHOH01-01, NPEC01-09

Comment and Response: 19-2

Comment:
Several comments expressed opinions that the most viable location for hydropower was Railroad Creek, Tenmile Creek, or Sixmile Creek.

Response:
Thank you for your comments. The Agencies and Intalco will evaluate alternative locations for siting a hydroelectric generating facility during Remedial Design.

Unique comment(s) addressed:
FPOS01-03, PHOL02-01, PJAM01-01

Comment and Response: 19-3

Comment:
Has solar energy been considered? Can be used a long time in summer. Can it be stored in winter since you can't use it due to the snow.

Response:
The Agencies have adopted TBCs that include green remediation techniques, and are open to consideration of whether solar power should be part of the remedy.

Unique comment(s) addressed:
MHOH01-02

Comment and Response: 19-4

Comment:
There is a very, very major concern that insufficient engineering and thought will go into the design of the hydroelectric expansion and modernization. A great deal of thought needs to go into it, or we will end up with a system that is extremely complex, extraordinarily expensive, and/or not maintainable or operable.

The portion of the plan addressing energy input has been abbreviated more than it should be at this stage of the presentation. Without more specifics around the energy input issue, particularly the long-term aspects of assuring a safe, reliable, and maintainable energy supply will be available to sustain remedy operations, the remedy effort could be a total waste.

I support hydropower. It would be well to have specifics outlined up front in the planning process, including the public meetings.

Concerns regarding complexity of operation and maintenance of possible hydroelectric systems considered. Please give serious consideration to putting a hydropower facility at 6 Mile Creek into the plan, this is the best option. Maintenance and operation is just as important as designing it; this burden will be simplest if a single hydro unit is located at 6 Mile Creek.

Response:
The Agencies understand concerns that the remedy, including necessary electric power supply components, should be well engineered and not result in unnecessarily complex operations and maintenance. The ROD incorporates green remediation strategies as TBCs and expresses the Agencies' preference for use of hydroelectric power for electric generation rather than petroleum-based fuels, to the extent practicable. Details of the proposed power supply systems, including planning for operations and maintenance, are expected to be developed by Intalco under the Agencies' oversight during Remedial Design.

Unique comment(s) addressed:
PHOL01-01, PHOL02-01, MSCH01-05

Comment and Response: 19-5

Comment:
Is FERC going to give you discompensation (sic) for rules and regulations for getting permits or do you have to go through the same process? Can there be challenges to the proposed hydropower, for example by environmental groups?

Response:
The Agencies anticipate that the proposed hydroelectric facility will comply with the substantive requirements for new facilities of this type, but will be exempt from the procedural requirements for permits as any contemplated hydroelectric facility would be constructed on-Site as part of a CERCLA cleanup action.

Unique comment(s) addressed:
WPQA01-15

Comment and Response: 19-6

Comment:
Holden Village needs additional power also, and a new facility on Railroad Creek or Ten Mile Creek could support the remedy and Holden Village year round.

Response:
The Agencies expect that Holden Village and Intalco will have regular discussions about implementation of the Selected Remedy.

Unique comment(s) addressed:
PJAM01-05

Comment and Response: 21-16

Comment:
One comment writer addressed the Agencies' prior comments (Forest Service 2010b) on Intalco's Alternative 13M report (ERM and URS 2009), regarding the lack of opportunity for the agencies to have timely input to the fall 2009 sampling event. The comment writer noted that Intalco agrees and intends to provide Agencies sufficient time for review and approval in accordance with the AOC (Administrative Order on Consent) for future sampling. The comment provided an explanation of why insufficient time was given in this circumstance.

Response:
Thank you for your comment.

Unique comment(s) addressed:
URSC05-01

Comment and Response: 29-2

Comment:
One thing I noticed that was not discussed at all in the plan and supporting documents is the intrinsic link between the long-term success of this project and the continued viability of Holden Village. Is $30M really going to keep this road open for the next 200 years? I do not think so. It is Holden Village that is going to make this project succeed. There needs to be an evaluation of how the remedy will impact us and how we can ensure the continued viability of Holden Village in order to ensure the viability and success of this treatment program.

Response:
The ROD does not require that Holden Village be involved in implementation of the Selected Remedy. The role of Holden Village in relation to the remedy implementation is not determined in this ROD.

The $30 million amount referred to is the Agencies' estimate of the net present worth (i.e., the amount that needs to be placed in an interest-bearing account at a seven percent discount rate) that is needed to fund operations and maintenance of the remedy including the groundwater collection and treatment system. This figure does not specifically include maintenance of the Lucerne Holden Road, which is maintained as part of the Okanogan Wenatchee National Forest.

Unique comment(s) addressed:
HJOH01-01

Comment and Response: 32-1

Comment:

We support Alternative 14's more benign approach to cleanup of the Honeymoon Heights Waste Rock Piles. This alternative helps maintain existing habitat and protect the environment. We prefer to minimize site intrusion by heavy machinery, and fear possible stope collapse if heavy equipment is used.

Are all the Agencies in agreement that you are not going to go up to Honeymoon Heights and try to remove those waste rock piles? Are you confident that is going to be accepted? I think it would be disastrous to remove the Honeymoon Heights Waste Rock Piles. That would be just so difficult.

Response:

The Agencies evaluated Alternatives 11M and 14, as described in the ASFS and the Proposed Plan, and determined that the long-term risk of environmental damages outweighs the potential benefit of reconstructing an access road on Honeymoon Heights and removing those waste rock piles. The ROD includes institutional controls and *in situ* treatment as a less intrusive alternative that is anticipated to eliminate the risk to human health and terrestrial receptors, respectively, resulting from hazardous substances being released from the Honeymoon Heights Waste Rock Piles.

Unique comment(s) addressed:

JMAT01-07, WPQA01-19

Comment and Response: 32-2 and 32-3

Comment:

Some commenters reiterated Intalco's TEE findings regarding minimal risk and limited habitat values of Honeymoon Heights waste rock piles. One commenter argued against removal of the Honeymoon Heights waste rock piles, in part because the disturbed areas would be subject to invasion by fugitive exotic species.

Several comments took issue with the Agencies' comments (Forest Service 2010b) on Appendix B (URS 2009) of the draft Alternative 13M Evaluation Report that addressed Intalco's assessment of the feasibility of accessing Honeymoon Heights for removal of waste rock that was part of Alternative 11M. The comments provided several clarifications and reiterated Intalco's conclusion that it did not think it was safe to access Honeymoon Heights with heavy equipment.

Response:

The ROD does not propose to remove the Honeymoon Heights Waste Rock Piles; rather, *in situ* remediation pilot tests are required. As described in the ROD, the Selected Remedy provides a means of reducing risk of releases from the Honeymoon Heights Waste Rock Piles that do not result in secondary environmental problems, such as long-term erosion and instability, and potential opportunities for invasive species.

Intalco's analysis of the TEE (ERM-West 2009a) was flawed (Forest Service 2009), and reanalysis of these data that are presented in ASFS (Table 10 and Appendix E), which identified risks to terrestrial receptors in the areas noted in the comment, as well as in other areas of the Site. No new information was provided in the comments on Appendix B of the Alternative 13M report, and the

Agencies original comments on the feasibility of Alternative 11M (Forest Service 2010a and 2010b) are unchanged.

Unique comment(s) addressed:
ERMW03-20, URSC01-01, URSC01-02, URSC01-03, URSC01-04, URSC01-05, URSC01-06, URSC01-07, URSC01-08, URSC01-09, URSC01-10

Comment and Response: 34-4

Comment:
One comment followed up on prior Agency comments (Forest Service 2010b) on Intalco's hydrogeological analyses that were presented in the Draft Alternative 13M Evaluation Report (ERM and URS, 2009). The comment questioned the value of installing additional deeper groundwater wells to assess migration of contaminants downgradient of the tailings piles. The comment noted that there are limited deep groundwater impacts and shallow wells would be better.

Response:
Thank you for your comment. The comment does reflect information used for selection of a remedy as discussed in the ROD.

Unique comment(s) addressed:
URSC07-36

Comment and Response: 34-5

Comment:
Several comments followed up on prior Agency comments (Forest Service 2010b) on Intalco's hydrogeological analyses that were presented in the Draft Alternative 13M Evaluation Report (ERM and URS, 2009) and provided clarification of several areas:

- *Explanation of drawdown measurements, and why Intalco's analytical method was applied appropriately;*
- *Reiteration of skin effects on slug tests versus pumping tests to explain the different results from different tests;*
- *Explanation of why different aquifer thicknesses were used in interpreting slug test versus pump test data;*
- *Hydrostratigraphic units were assigned based on review of cores not from pump tests, and providing a description of units screened in wells for pump tests.*
- *Intalco used generally accepted simplifying assumptions as part of its pump test data interpretation, and providing a discussion of pump and slug tests.*

Response:
Thank you for your comments. These comments do not affect selection of a remedy.

Unique comment(s) addressed:
URSC04-18, URSC04-19, URSC04-20, URSC04-15, URSC04-16

Comment and Response: 34-6 and 34-7

Comment:
Some comments followed up on prior Agency comments (Forest Service 2010b) on Intalco's hydrogeological analyses that were presented in the Draft Alternative 13M Evaluation Report (ERM and URS, 2009) and provided several clarification of infiltration modeling:

- *Intalco's conceptual plan for a waste landfill has top and bottom geomembrane liners and is approximately 1 acre in size; therefore, it was judged not to significantly affect HELP results on 72 acre of tailings piles and omitted from those analyses; also*
- *The sludge landfill was soil lined on Tailings Pile 1. It was judged to have similar infiltration to the soil cover modeled in HELP if operated properly.*

Another comment noted that the tailings pile cover permeability was estimated to be comparable to silty sand. The comments noted that landfills and tailings pile cap will be further evaluated during design.

Response:
Thank you for your comments. These comments do not affect selection of a remedy.

Unique comment(s) addressed:
URSC04-13, URSC04-12

Comment and Response: 35-1

Comment:
Some comments followed up on prior Agency comments (Forest Service 2010b) on Intalco's hydrogeological analyses that were presented in the Draft Alternative 13M Evaluation Report (ERM and URS, 2009) and provided clarification of modeling that Intalco used for evaluation of the groundwater barrier and collection system:

- *The hydraulic conductivity of the barrier wall used in the model was an estimate based on conceptual design. The model or design of wall material may be adjusted to be consistent with the remedy and to refine wall design.*

- *Discussion of field-measured versus modeled vertical gradients represent. Inflow into collection trench/ponds will depend on many factors, and a sensitivity analysis of hydraulic conductivity could be performed during design.*

- *Minimum low-flow conditions are commonly accepted to represent base flow conditions. Base flow can vary seasonally; and Intalco's statement was not intended to imply base flow is constant.*

.

- *The effects of hydrologic boundaries increase with proximity and conclusions from the model near boundaries are not unreliable. Boundary conditions are representative of observed and interpreted site data.*

- *Comparisons of the direction of vertical gradients in the field and the model are more important than comparing the magnitude of the gradients for judging the model. Field data support the interpreted high permeability deposits, contrary to Agencies' comment.*

- *Explanation of why some model cells are flooded; these are not significant to the model results or remedy evaluations.*

- *Intalco's attempted regional model was not unsuccessful, but it demonstrated the need for fine discretization, and was a starting point for telescoped models.*

- *Models based on available data and used to make recommendations for additional data collection. Model consistent with additional data collected. Model mass balance found to be consistent with high and low flow conditions and reasonably approximates groundwater conditions at the Site.*

- *Model is consistent with staff gage and well point data and water quality data. Dissolved constituents generally decrease from RC-2 to RC-3.*

- *Intalco believes the model is accurate with the lowest heads north the RRC channel immediately east of Tailings Pile 3 based on several types of available data.*

- *The Railroad Creek – Copper Creek connection was intentionally not modeled. The Copper Creek extension channel would be lined and disconnected from groundwater, so it was omitted. Model does not include surface water flow, only groundwater flow and mass flux between groundwater and surface water.*

- *Leakage is controlled primarily by the vertical hydraulic conductivity, which is unknown for pond not yet designed/built. Vertical gradients are of secondary importance.*

Response:
Thank you for your comments. These comments do not affect selection of a remedy.

Unique comment(s) addressed:
URSC04-08, URSC04-09, URSC04-14, URSC07-58, URSC04-06, URSC04-11, URSC04-01, URSC04-02, URSC04-03, URSC04-05, URSC04-17, URSC04-07

Comment and Response: 37-6 and 39-1

Comment:
Some comments expressed concern about the impacts of constructing the first and/or second phase groundwater barrier walls, including:

- *I hope that all due respect is given to the total impact of this remedy, so that the second phase is not necessary.*

- *It is important that when [the Agencies and Intalco] work things out in design, that they take into account the impact of keeping or building the groundwater barrier wall, making sure that it really is needed before implementing it because it will have a lot of impact just itself in putting it in.*

- *Construction of the contingent barrier wall will cause significant adverse environmental impacts: hundreds of tons of additional greenhouse gas emissions and additional risk of fuel spills.*

- *The added risk of environmental degradation, the massive quantities of fossil fuels, the resultant greenhouse gases will far outweigh the benefit of water quality.*

Response:
Existing data demonstrate that groundwater must be contained to protect aquatic life in Railroad Creek from discharges above cleanup levels protective of surface water and exceeds MCLs under and beyond Tailings Piles 2 and 3. Therefore, the groundwater barrier around the Tailings Pile 1 and the Lower West Area will be constructed during Phase 1 of the Selected Remedy, and a second groundwater barrier around Tailings Piles 2 and 3 will be constructed during Phase 2 of the remedy, which is anticipated to begin five years after the completion of the first phase.

Existing information indicates that the Phase 2 barrier is necessary to protect receptors in Railroad Creek and to contain groundwater above MCLs . A possible determination of whether the Phase 2 groundwater barrier wall may be modified or not need to be installed would be based on an evaluation of the results achieved before and following the implementation of Phase 1 remedy components, as described in Section 12 of the ROD.

Unique comment(s) addressed:
CHIN01-05, TANE01-05, MWHA01-25, KBLO01-02

Comment and Response: 40-2

Comment:
Some comments expressed concern for the environmental impact of the proposed groundwater treatment system. These included:

- *[The Agencies] should seek something small, simple, and energy efficient to minimize power consumption. Avoid a system that produces solid waste that would need to be transported to a landfill down lake. Look for a technology with little to no operator licensing requirements, so Holden staff may provide support.*

- *Choice of a passive treatment system is critically important to the health of the entire watershed. The majority of water [should be] treated with a passive system that does not require additional electrical energy to participate in that process. If additional energy is required in significant amounts it would mean a significant change in the hydroelectric system or continued transport of petrol to Holden Village. Transporting diesel to Holden Village to power the treatment system is a very hazardous process and would put a tremendous burden of risk on the entire valley, not just the Holden Village area.*

Response:
The Agencies understand concerns that the remedy, including the groundwater treatment facility should be well engineered and not result in unnecessary waste generation or overly complex operations and maintenance requirements. The Draft Final Feasibility Study included a detailed analysis of treatment alternatives, and the Selected Remedy includes the best available technology for conditions at the Site. The ROD incorporates green remediation strategies as TBCs and expresses the Agencies' preference that hydroelectric power be used for electric generation rather than petroleum-based fuels to the extent practicable. Details of the proposed groundwater treatment systems, including planning for operations and maintenance will be developed during Remedial Design.

Unique comment(s) addressed:
MSCH01-04, WDAL01-02

<u>Comment and Response: 45-1</u>

Comment:
If found during remedy implementation, Dangerous Waste will be addressed in accordance with ARARs

Waste rock relocated to Mill Building footprint with 1 foot of vegetated cover will meet Agencies' performance standards.

Response:
The ROD notes that waste characterization within the former Mill Building is incomplete, and that Dangerous Waste, if encountered during remediation, will need to be managed in accordance with ARARs. Although two feet of soil were used for cost estimating purposes for Alternative 14 as discussed in the ASFS, the design of caps for waste rock, tailings, and any other impacted soils or waste materials left in place, will need to be completed during Remedial Design.

Unique comment(s) addressed:
ERMW03-01, ERMW03-15,

<u>Comment and Response: 45-2</u>

Comment:
The requirement to characterize, remove, and dispose of soil and mill residual elsewhere is unnecessary, provides no additional protection of human health and the environment, is unsafe, and is not practically implementable. Burial of the mill residuals in place is protective. Once buried, these materials are unlikely to leach and are within a groundwater containment system.

Materials in the former mill are not listed as dangerous waste and unlikely to behave as dangerous waste. The former mill is within a WMA and Agencies have flexibility to allow Intalco's proposed solution.

Intalco's proposed solution meets performance standards and is safer and more cost effective.

Response:
Mineral concentrates include characteristic Dangerous Wastes, e.g., by failing TCLP test criteria. Such materials may need to be stabilized to qualify for land disposal, regardless of the groundwater containment system that is part of the Selected Remedy at the Holden Site. Alternatively, these materials may be managed in accordance with their characteristics by final disposal in a facility that will assure long-term protection of the environment.

A WMA is a contaminated groundwater management concept based in RCRA requirements (see 40 C.F.R. § 264.95), and implemented in accordance with CERCLA and the NCP, that allows MCL exceedances where restoration to MCLs throughout the Site is not practicable and where groundwater is contained. The WMA concept does not pertain to managing solid or dangerous wastes other than in relation to the point of compliance for groundwater cleanup under CERCLA.

Unique comment(s) addressed:
MWHA01-49, INTA01-46

<u>Comment and Response: 45-3</u>

Comment:
The steep slopes and dilapidated condition of the Mill Building present undue hazards to site workers.

Response:
Conditions at the former Mill Building are not substantially different from other deteriorated structures that have been safely demolished at other sites using conventional techniques.

Unique comment(s) addressed:
INTA01-45

<u>Comment and Response: 45-4</u>

Comment:
You are going to store the [former mill] structure somewhere on site, not take it out, and you are going to clean out the foundation. Do you leave the foundation there and fill it with rock from the waste piles?

Response:
After demolition and removal of wastes, slopes at the former Mill Building will be stabilized and revegetated. Some of the foundation elements may be left in place if their removal is not necessary to clean up mill wastes.

Unique comment(s) addressed:
WPQA01-08

Comment and Response: 47-1

Comment:
Alternative 13M would contain the primary sources of contamination and does not rely primarily on dilution and dispersion. The relocated Railroad Creek would be isolated from groundwater adjacent to Tailings Piles 2 and 3 allowing natural attenuation to occur before discharging to surface water. Contingent actions would be evaluated if not meeting RAOs and ARARs. Intalco does not propose to use a mixing zone for monitoring groundwater to surface water impacts.

Response:
The final Feasibility Study shows that Alternative 13M would not contain the primary sources of hazardous substances that are being released into Railroad Creek and would not attain MCLs under Tailings Piles 2 and 3. Figures 6 through 11 in the ROD show that groundwater below and downgradient of Tailings Piles 2 and 3 have concentrations of aluminum compounds, cadmium, copper, iron compounds, and zinc that exceed cleanup levels by one to four orders of magnitude (concentrations vary depending on constituent, location, and seasonal conditions). The final Feasibility Study indicates that without a groundwater barrier and collection system, this groundwater would continue to degrade water quality and aquatic habitat in Railroad Creek for hundreds of years.

The relocated reach of Railroad Creek north of the tailings piles could be hydraulically isolated to prevent groundwater base flow from conveying hazardous substances into the creek, but this would not protect Railroad Creek downgradient (east of Tailings Pile 3) of this engineered reach., as indicated on Figure 9 of the ROD.

There is no need to rely on the proposed future evaluation of contingent actions. Available information demonstrates both the need for, and feasibility of, eliminating base flow of groundwater impacted by releases from Tailings Piles 2 and 3 into Railroad Creek.

The Agencies concur that it would be inappropriate to rely on a mixing zone for assessing groundwater seepage into Railroad Creek. Groundwater quality monitoring will be accomplished in accordance with WAC 173-340-720(8)(e) and (9)(a).

Without containment, there can be no WMA and MCLs would need to be met throughout the Site, including under Tailings Piles 2 and 3, or there would need to be an ARAR waiver for MCLs based on technical impracticability from an engineering perspective, which, if justified, would require a ROD Amendment. Such an ARAR waiver would not be approved unless the remedy was shown to be protective, including the protection of aquatic life where groundwater discharges to surface water, and the establishment of institutional controls to prevent use of groundwater for drinking water below the tailings piles.

Unique comment(s) addressed:
URSC07-13

Comment and Response: 49-1

Comment:

The Agencies should look to Zapata (successor to Granby) for remediation of the Honeymoon Heights waste rock, impacted soils, and impacted groundwater.

Response:

Comment noted for future reference. The possibility that another entity may be responsible for particular response costs is not relevant to selecting an appropriate remedy.

Unique comment(s) addressed:

TGAR01-62

Comment and Response: 23-1

Comment:

One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) by providing additional information and drawings explaining how the volume of tailings regrading was estimated in Intalco's cost estimate.

Response:

Thank you for the clarification. The Agencies independently arrived at similar overall regrading volumes and costs (i.e., differences of approximately 5 percent or less) for the cost estimates used in the ASFS.

Unique comment(s) addressed:

URSC09-12

Comment and Response: 23-2

Comment:

One comment addressed the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) by explaining why Intalco's estimate of tailings regrading costs for Tailings Pile 1 under Alternatives 11 and 13M were different. The commenter also indicated that the note in Intalco's cost estimate backup spreadsheet stating the tailings regrading costs for Tailings Pile 1 should be the same for Alternatives 11 and 13M was a remnant of a past estimate and the note should be deleted or considered not applicable.

Response:

Thank you for the clarification.

Unique comment(s) addressed:

URSC09-13

Comment and Response: 23-3

Comment:

The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that similar approaches to constructing the tailings piles toe berms could have been *used for Alternatives 11 and 13M. However, Intalco's cost estimate included a toe berm composed only of quarry rock for Alternative 11, while including a toe berm composed of a combination of quarry rock and compacted tailings for Alternative 13M. Because the cost of quarry rock was estimated to be six times that of compacted tailings, the Agencies had previously commented that Intalco's cost estimate exaggerated the cost difference between Alternatives 11 and 13M by not using similar approaches.*

The commenter indicated that replacing rock with compacted tailings in the Alternative 11 toe berm cannot be assumed because:

- *Alternative 11 requires a more robust toe berm due to the additional regrading required to setback the tailings from Railroad Creek, which exposes weaker tailings in the face of the slope.*
- *Compacted tailings do not have the same unit weight as quarry rock.*
- *Intalco did not advance the design of the Alternative 11 toe berm to limit deformations or prevent potential failure during the maximum design earthquake but left this to final design if Alternative 11 is selected.*

Response:
The Agencies concur that a more robust toe berm would be needed for Alternative 11 based on the additional regrading compared with other alternatives. The Agencies agree that compacted tailings would not have the same unit weight as quarry rock. The Agencies also understand that Intalco did not advance the feasibility level design of Alternative 11 to the same degree as Alternative 13M, which was modified from Alternative 13 based on additional data collected and analyses performed in 2008 and 2009.

As part of modifying Alternative 11 to Alternative 11M, the Agencies advanced the feasibility level design of the tailings regrading and stabilization to provide a cost comparison to Alternative 13M that is based on a comparable level of detail. This is reflected in the ASFS and comments on the Alternative 13M report.

The Agencies advanced the feasibility level design of Alternative 11M based on limit equilibrium slope stability analyses, which were modified from the analyses Intalco provided for the Agencies' review. The Agencies developed the Alternative 11M toe berm geometry and compacted tailings/ quarry rock composition necessary to provide acceptable post-earthquake stability per the ARARs (Washington Dam Safety criteria).

The Agencies' analysis of Alternative 11M resulted in a more robust toe berm compared to Alternative 13M, based on exposure of the lower strength tailings in the slope from the additional regrading required. The Agencies' analysis of Alternative 11M accounted for the differences in both unit weight and shear strength of the compacted tailings and quarry rock.

Unique comment(s) addressed:
URSC09-14

Comment and Response: 23-4

Comment:

The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that there appeared to be double handling and compaction costs in the Alternative 13M cost estimate because hauling and compaction costs were included in the cost line items for both the regrading and the toe berm compacted tailings.

The commenter acknowledged there may be some potential savings if the tailings used for the toe berm may be stockpiled and not compacted. However, the commenter noted the rationale for the double-handling was due to unavoidable site logistics and construction coordination constraints.

Response:

Comment noted. Thank you for the clarification regarding Intalco's Alternative 13M cost estimate. This issue has a relatively small impact on cost comparisons presented in the final Feasibility Study, but does not affect remedy selection because Alternative 13M does not satisfy the threshold requirements for selection of a permanent remedy.

Unique comment(s) addressed:

URSC09-15

Comment and Response: 23-5

Comment:

The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that the cost of the compacted alluvium portion of the toe berm for Tailings Pile 3 needed for slope stability, appeared to be omitted from the cost estimate. Additionally, there does not appear to be sufficient space for construction of the compacted alluvium portion of the toe berm where Railroad Creek is adjacent to Tailings Pile 3.

The commenter explained a work pad would be necessary for construction of the Alternative 13M contingent barrier wall, but the compacted alluvium is a work pad outside the toe berm required for stability. This section of Tailings Pile 3 with the work pad and the contingent groundwater barrier wall was evaluated for stability because it represents the worst-case conditions, as groundwater levels would be elevated due to the presence of the groundwater barrier wall. However, the alluvium work pad is not required under Alternative 13M. The toe berm around Tailings Pile 3 would be similar to those for Tailings Piles 1 and 2, and the anticipated relocation of Railroad Creek would result in there being sufficient room to construct the toe berm. Since the contingency barrier is not part of the Alternative 13M base cost estimate, costs for the work pad at the toe of Tailings Pile 3 were not included.

Response:

Comment noted. Thank you for the clarification regarding Intalco's Alternative 13M cost estimate. This issue has a relatively small impact on cost comparisons presented in the final Feasibility Study, but does not affect remedy selection because Alternative 13M does not satisfy the threshold requirements for selection of a permanent remedy.

Unique comment(s) addressed:
URSC09-16, URSC09-17, URSC02-20

Comment and Response: 23-6

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that Intalco's cost estimate appeared to use significantly different unit prices for the landfill geomembrane for Alternatives 11 and 13M without justifying the difference. Additionally, the cost estimate assumed different liner thicknesses for Alternatives 11 and 13M.

The commenter indicated consistent liner thicknesses (60 mil) were assumed for the cost estimates of both Alternatives 11 and 13M. Consistent pricing was used for the geomembrane and geosynthetic components for the [Alternative 11] waste rock pile and tailings pile covers: $0.48 per square foot installed for 60 mil LLDPE (for flatter surfaces) and $0.51 per square foot for 60 mil "Microspike" liner (for steeper slopes). Consistent pricing was also used for the lined solid waste facility geomembrane: $0.60 per square foot (higher cost due to small area and greater percentage of detailed work).

Response:
Thank you for the clarification regarding Intalco's cost estimates. The Agencies rechecked the cost estimates and confirmed a consistent thickness of 60 mil was assumed for the geomembrane materials in Intalco's cost estimate. The Agencies also confirmed the unit costs were used as described by the commenter for the waste rock pile and tailings pile covers and will disregard the other unit costs shown in Intalco's estimate that were apparently not used for the final cost estimate. However, the Agencies confirmed that different unit costs were used for the 60 mil HDPE liner in Intalco's Alternative 11 cost estimate ($0.60 per square foot) versus Intalco's Alternative 13M cost estimate ($0.48 per square foot) for the same slope conditions. While these unit costs are significantly different, the overall impact of this difference is moot since Alternative 13M did not satisfy the threshold requirements for remedy selection.

Unique comment(s) addressed:
URSC09-18

Comment and Response: 23-7

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that Intalco has provided conflicting characterizations of the weak and potentially liquefiable layer referred to as Zone 4 or "overbank material." This soil unit appears to be a controlling factor for slope stability. Intalco has interpreted an historical, pre-construction document that states "cleaning (sic) of logs, stumps, and duff to mineral soil on outside edge under toe dam," to indicate the material classified as overbank material was removed and is not present below the tailings pile starter dams. The overbank material was originally described by Intalco as highly organic, but this was revised to silty sand to sandy silt (i.e., mineral soil) with occasional organic materials up to approximately four feet thick.

The commenter indicates the interpretation of the overbank material has evolved over time as additional information has been developed by investigation and sampling. Intalco believes there is strong indirect evidence supporting the lack of overbank material below the starter dams. However, due to the difficulty in sampling overbank material at the toe of the current embankment, Intalco agrees that direct evidence is lacking. This material is an issue for stability due to its low strength, and its origin is important in evaluating its continuity across the Site.

Response:
Comment noted. The Agencies generally concur with the comment regarding the evolution of the classification of the overbank materials. However, the Agencies disagree there is strong indirect evidence that the tailings pile starter dams are not underlain by overbank material (i.e., potentially liquefiable material). This issue relates to the stability analyses that are required for design of all the remedial alternatives, but is not a differentiator between remedial alternatives. Although this does not affect remedy selection, it will need to be addressed further as part of Remedial Design.

Unique comment(s) addressed:
URSC02-01, URSC02-04 (partial)

Comment and Response: 23-8

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) on the presence or absence of a starter dam along the toe of the tailings piles. The Agencies had previously commented that the assumptions used in Intalco's back analysis (intended to demonstrate the overbank material must have been removed from below the tailings pile starter dam and to estimate the degree of cementation for the outer tailings materials) did not appear to represent the slopes observed in the referenced historical photographs. Additionally, the back analysis does not necessarily reflect the effect of the elapsed time on the development of cementation due to oxidation in the near-surface tailings. The Agencies also commented that the lateral extent of the zone of cementation in the back analysis was greater than that observed in the field in 2009. Intalco will need to provide a more complete assessment of the cemented tailings strength properties and extent, if cementation will be relied upon to justify steeper slopes in Remedial Design.

The commenter disagrees with the Agencies' comments and believes the historic photograph previously provided supports the steepness of the slope as modeled in the back analysis (i.e., almost 52 degrees) and also described in the historical documents. The commenter does not agree that the fact that the photographs do not show the starter dam exposed at the end of construction is evidence that the starter dam was not built, or that it was covered by sloughing or erosion. Instead the commenter indicates the historic photos indicate that a laborer hand placing the tailings sand at the perimeter of the pile with a shovel is not likely to be particularly careful regarding the exact location of each shovelful of sand placed, and this resulted in tailings being shoveled over the outer face and obscuring the starter dam.

Regarding the minimum strength properties for the outer tailings materials, the commenter indicated two back analyses were performed. One back analysis was performed to estimate the minimum friction angle necessary to support the construction slopes, which assumed minimal cohesion. A second back analysis was performed to estimate the minimum cohesion increase that *must have occurred to support the observed slopes. This was intended to provide lower-bound cohesion for the outermost tailings, not the actual cohesion as implied by the Agencies' comment. Regarding cementation, the commenter indicated block samples tested for shear strength along with Scanning Electron Microscope images from the 2009 field and laboratory testing program provided confirmation of the cementation between the tailings particles. Cohesive strength gain would be considerable with the degree of cementation observed. The commenter also indicated Intalco anticipates the data available after completing the back analyses will be incorporated in Remedial Design, but Intalco does not intend to rely on cementation to justify steeper slopes.*

Response:
Comments noted.

The Agencies maintain that the historical photograph appears to indicate the tailings may have been hand placed at an angle between 40 and 50 degrees, depending on whether it is assumed the camera was vertical or the trees in the background were vertical. As suggested by the commenter, the hand placement of tailings over the starter dam may have also been a reason it was concealed by tailings at the end of construction, and is not visible today. The historical photographs also appear to show the buildup of colluvium at the base of the tailings piles, which supports the interpretation of potential sloughing or erosion during construction.

If the back analysis assumed higher slope angles than existed at the end of construction, then the minimum frictional and cohesive (i.e., cementation) tailings strength properties estimated would be higher to support these steep slopes. As the Agencies noted, the historical photographs, as well as additional field observations after the back analyses were completed (i.e., lateral extent of cementation noted in URS' test pits), appear to indicate end of construction conditions were not necessarily as modeled in the back analysis. Therefore, conclusions about stability of the tailings piles based on the back analysis may not be reliable.

The additional data available after the completing the Alternative 13M report (ERM and URS 2009) should be considered during Remedial Design.

Although the Agencies disagree with the noted aspects of Intalco's back analysis and characterization of tailings cementation (the effect of cementation on stability of the tailings will need to be addressed during Remedial Design), this was not a factor in remedy selection. This issue relates to the stability analyses that are required for design of all the remedial alternatives, but is not a differentiator between remedial alternatives.

Unique comment(s) addressed:
URSC02-02, URSC02-17, URSC02-18

<u>Comment and Response: 23-9</u>

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that investigations and excavations near the toe of the tailings piles have not revealed the starter dam in the location near the existing surface indicated in Intalco's cross sections, and no field evidence supports Intalco's contention that liquefiable soils are absent under the starter dam. Additionally, the condition of the starter dam is unknown.

The Agencies previously commented that Intalco only considered the silty sand overbank material would behave as an undrained material over the period of tailings deposition and Intalco intended this portion of the back analysis to demonstrate the overbank materials must have been removed or the tailings piles would have failed. However, Intalco did not investigate the possibility that the silty sand overbank materials may have exhibited drained behavior, which would result in an increase in back analyzed static stability. The Agencies noted that Intalco's back analysis did not demonstrate the absence of liquefiable materials under the tailings pile starter dams.

The Agencies also commented Intalco's tailings pile seismic stability and deformation analyses for Alternative 13M were highly sensitive to whether or not liquefiable material (i.e., overbank material) was present below the starter dam, which Alternative 13M relies on as part of the toe berm design for stabilizing the tailings piles. Thus, the possibility of liquefiable soils below the toe of the tailings piles will need to be included in remedial design analysis, unless future field evidence conclusively demonstrates that liquefiable materials are not present anywhere along the toe of the tailings piles.

The commenter notes it is more accurate to say that there is no direct field evidence to support either the presence or absence of liquefiable soils beneath the starter dam, and even isolated investigations may not resolve this. Field evidence is not available to conclusively establish the presence or absence of liquefiable materials beneath the toe of the tailings piles due largely to the access difficulty. In the absence of direct field evidence regarding the liquefiable soils, the commenter suggested it is Intalco's contention that indirect evidence and engineering judgment are appropriate for establishing design parameters.

The commenter indicates the construction stability of the tailings slopes is an important element of indirect evidence. The commenter states the rate of rise for the tailings impoundments is correctly represented by undrained conditions, and referred to "countless" case histories that testify to the veracity and reliability of undrained back analysis of tailings dam construction slopes. The commenter cautions that reliance on drained analysis has in several cases led to construction failures.

The commenter indicated the most compelling evidence that weak layers are not present is the good stability performance of the entire length of tailings embankment since initial construction, the equipment used to compact the starter dike, and the back analysis demonstrating weak layers would have caused failure during construction.

The commenter indicates that even if the silty sand of the overbank materials were left in place as the "mineral soil" cited in construction documents, construction/compaction of the starter dam would tend to result in densification and a decreased likelihood of liquefaction. Thus, overbank beneath the starter dams is unlikely to be in the same loose consistency as overbank material elsewhere at the Site.

Response:
The Agencies agree there is no direct field evidence to support whether potentially liquefiable materials are present or absent below the tailings pile starter dams because no field explorations have revealed the starter dams. However, explorations for Alternative 13M near the toe of the tailings piles revealed overbank materials and borings through the tailings piles indicated overbank materials are present below the tailings piles up to approximately 4 feet thick.

Regarding the use of drained versus undrained materials properties, the Agencies' comment referred to the behavior of the silty sand overbank materials, particularly the silty sand overbank materials near the toe of the constructed tailings slope and under the starter dam, and not to drained analyses of the tailings themselves. The Agencies agree undrained analyses would be more appropriate for global analyses involving the tailings, especially the finer grained tailings toward the pile interior. However, Intalco decided to model the tailings based on the long-term (i.e., present day) drained parameters in the back analysis, and only modeled the overbank material based on undrained strength. Although the Agencies disagree with aspects of Intalco's back analysis and these differences of opinion will need to be resolved during Remedial Design, the back analysis was not a factor in remedy selection.

The Agencies also agree there is no evidence that the tailings piles have exhibited any deep-seated slope failure since being constructed. This may indicate that the overbank soils have acceptable strength under static loading (although the margin or factor of safety is not known); however, this does not indicate the soils below the starter dam would not liquefy and become very weak during a seismic event, which could result in a failure of the tailings pile slopes.

The Agencies qualitatively recognize that construction of a starter dam could have resulted in an increase in the density of the overbank materials below the starter dam, depending on the means and methods of constructing the starter dam. The method of construction of the starter dam for each tailings pile is unknown. The condition and locations of the starter dam(s) are unknown and the condition of the soils below the starter dam(s) is unknown. While Intalco can speculate the overbank soils below the starter dam are denser and less susceptible to liquefaction than overbank materials observed beyond the toe of the tailings piles or in boring within the interior of the tailings piles, the Agencies do not agree this assumption is reasonable to rely on for design (that must satisfy the ARARs) based on the information available.

The Agencies disagree with Intalco's positions that there is strong indirect evidence that the tailings pile starter dams are not underlain by overbank material (i.e., potentially liquefiable material). Given a) the absence of direct evidence that the overbank materials are not present below the starter dam, and b) the sensitivity of the tailings pile stability and deformation analyses to the presence of overbank materials below the starter dam, the Agencies maintain the possibility of liquefiable soils below the toe of the tailings piles will need to be included in remedial design analysis, unless future field evidence conclusively demonstrates that liquefiable materials are not present anywhere along the toe of the tailings piles. This issue relates to the stability analyses that are required for design of all the remedial alternatives, but is not a differentiator between remedial alternatives. Although this does not affect remedy selection, it will need to be addressed further as part of Remedial Design.

Unique comment(s) addressed:
URSC02-03, URSC02-04 (partial), URSC02-19

Comment and Response: 23-10

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that Intalco's feasibility level slope stability and deformation analyses may not have adequately accounted for the worst-case groundwater conditions in the selected critical sections.

Critical sections were selected based on static stability results which were relatively insensitive to groundwater levels. However, the dynamic analyses appear to be driving the requirements for stabilizing the tailings piles, and the dynamic analyses are more sensitive to groundwater levels that affect the volume of potentially liquefiable tailings. Additionally, the Agencies note that geophysical measurements and some of the cone penetration test (CPT) data indicated groundwater levels may be higher than measured in the monitoring wells.

The commenter indicated the elevated levels exist only for a couple of weeks during spring runoff and said it is unreasonable to subject the design to both extreme earthquake loading and spring runoff conditions under the same design criteria. The probability of these combined extremes occurring simultaneously is not a reasonable design case. Further, the remedial design will likely capture some water upslope and decrease infiltration into the tailings, thereby reducing the expected maximum water levels. The commenter said it is reasonable to confirm that a reduced factor of safety above 1.0 would be maintained under extreme conditions. During Remedial Design, the groundwater levels used in the models may be re-evaluated, if additional data or modeling is developed that indicates it is appropriate to do so.

Response:
Comment noted. Ecology's Dam Safety Standards are relevant and appropriate, and provide a way to include the risk of seismic shaking with temporary seasonal high water levels. Design groundwater levels will need to be approved by the Agencies as part of Remedial Design. This issue relates to the stability analyses that are required for design of all the remedial alternatives, but is not a differentiator between remedial alternatives. Although this does not affect remedy selection, it will need to be addressed further as part of Remedial Design.

Unique comment(s) addressed:
URSC02-05

Comment and Response: 23-11

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that in addition to the overbank soils being potentially liquefiable, field data appeared to indicate the upper alluvial soils could also potentially liquefy during seismic events and this will need to be addressed during Remedial Design.

The commenter indicated the critical sections selected for tailings piles slope stability and deformation analysis are based on a combination of factors including slope angles, overbank thickness, etc. Altering each parameter on the critical section to match the worst case encountered on the Site would not result in an accurate model of the Site. The explorations indicated the overbank material varies in thickness over short distances as evidenced by the variability in adjacent boring explorations, and the commenter provided reasons for not relying on some of the explorations referenced in the Agencies' comment due to potential issues identified for specific explorations or sampling intervals.

Response:
Comment noted. The Agencies agree a worst-case scenario based on conditions from different areas of the site that are not representative of the actual conditions encountered at the Site should

not be the basis of design. However, when data indicate conditions exist or potentially exist, these conditions must be considered in design. The Agencies understand there may be reasons not to rely on certain Standard Penetration Test data (e.g., if the sampler were driven through slough) as indicated by the commenter. However, the entirety of the field data should be considered, including resolution and reliability of the field testing (e.g., discrete versus continuous testing methods). As noted by the Agencies, there is evidence the upper alluvial soils may be susceptible to liquefaction, and the thickness of native liquefiable materials below the tailings piles (including both overbank materials and loose alluvium soils) may be significantly greater than Intalco modeled in its base cases and sensitivity analyses. This issue relates to the stability analyses that are required for design of all the remedial alternatives, but is not a differentiator between remedial alternatives. Although this does not affect remedy selection, it will need to be addressed further as part of Remedial Design.

Unique comment(s) addressed:
URSC02-06

Comment and Response: 23-12

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that the thickness of Zone 4, which represents overbank materials in the models, was thinner in the models than the thickness of Zone 4 material interpreted by Intalco from CPTs. The CPT data represent the combined thickness of weak tailings and overbanks soils The difference could not be determined due to limitations of the CPT method. (CPTs do not provide a sample of the materials penetrated) Additionally, the CPT data formed the basis for estimating the static shear strength properties of Zone 4, due to limited lab data. If the Zone 4 used in the models were as thick as indicated in the Cone Penetration Tests the deformations would likely have been higher, and this will need to be accounted for in Remedial Design.

The commenter indicated the models accounted for this by modeling both the weak lower portion of the tailings and the overbank materials. The thickness of liquefiable materials was selected based on the explorations closest to the cross sections analyzed. Additional laboratory testing performed during 2009 indicates general agreement with the soil strengths used in the models.

Response:
Comment noted. The Agencies understand the liquefiable tailings were modeled separately from the overbank materials in Intalco's model. The Agencies' comment referred to the static strength properties assigned to the Zone 4 material based on CPT data, but the thickness of Zone 4 was modeled based on the observed thickness of overbank materials. The overbank material immediately below the weak tailings were assigned strength properties based on the CPT data, but the weak tailings represented by the same CPT data were not assigned the same weak strength. Rather the tailings in the model were assigned shear strength properties based on the tailings overlying this weak tailings zone. Although not a factor in remedy selection, these conditions will need to be addressed during Remedial Design.

Unique comment(s) addressed:
URSC02-07

Comment and Response: 23-13

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that there was limited or no data for assigning properties to model the seismic response of the Zone 4 overbank material, and the potentially liquefiable native soils will need to be better characterized regarding susceptibility to liquefaction and residual strength during Remedial Design, as opposed to treating them the same as saturated tailings.

The commenter indicated the overbank deposits were characterized based on their geotechnical properties, with similar residual strengths to the saturated tailings due to the similarities in field and laboratory test results, not as implied by the Agencies as due to a lack of data. Overbank material was not modeled as dilatant, even though 2009 laboratory data indicated it was slightly dilatant. Scanning electron micrographs performed on tailings and overbank soils in 2009 indicated the materials have similar angularity but the overbank soil grains are not as tightly packed as the tailings.

Response:
Comment noted. The additional data referenced will be considered in Remedial Design but does not affect remedy selection. If the overbank soil particles are not as densely packed as the tailings, they are likely more susceptible to loss of strength during liquefaction, and this will need to be addressed during Remedial Design.

Unique comment(s) addressed:
URSC02-08

Comment and Response: 23-14

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that the contractive/dilative soil behavior modeled before triggering of liquefaction will need to be based on soil behavior prior to liquefaction or analysis demonstrating the sensitivity of the modeled deformations to the pre-liquefaction contractive/dilative behavior will need to be provided during Remedial Design.

The commenter indicated because the post-cycling-dilation is a function of unidirectional shear strain, the only soil zones in the model which experience an increase in cyclic strength are those which have horizontal monotonic (static) shear stress superimposed on cyclic shear stress. As such, the post-cycling-dilation scheme is consistent with the well-established "alpha effect" where cyclic strength increases for soils subjected to pre-shaking monotonic (static) horizontal shear stress.

Response:
Comment noted. The information provided in the comment will be considered in Remedial Design but does not affect remedy selection.

Unique comment(s) addressed:
URSC02-09

Comment and Response: 23-15

Comment:

The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that the method Intalco used in the model to adjust the post-liquefaction residual undrained shear strength based on pore pressure dissipation (i.e., a drained condition) was unclear. Further clarification would need to be provided during Remedial Design for the Agencies to accept the use of these methods for final design of the tailings pile slopes. This could potentially be accomplished via a sensitivity analysis to assess the significance of the dilation effects on design.

The commenter indicated residual shear strength is considered the level below which shear strength cannot decrease, and there is no reason why shear strength could not increase again as excess pore pressures dissipate (e.g., due to post-cycling-dilation). The commenter acknowledged the Agencies would require further clarification to rely on dilation modeling for final design.

Response:

Comment noted. The information provided in the comment will be considered in Remedial Design but does not affect remedy selection.

Unique comment(s) addressed:

URSC02-10, URSC02-11

Comment and Response: 23-16

Comment:

The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that Intalco defined the liquefied soil strength at a shear strain of 10 percent from specimens previously cycled to liquefaction. At shear strain of 10 percent dilation is already occurring and contributing to the shear strength. Additionally, the dilation model adjusts pore pressures to increase strength within the initial 10 percent of shear strain experienced by soil in the deformation models. This, in effect, appears to double up the dilative behavior and resulting strength gain in the deformation models. The compatibility of the dilation model and liquefied shear strength will need to be addressed during Remedial Design.

The commenter indicated the cyclic soil testing was performed by applying perfectly symmetric loading without unidirectional monotonic shear stress being superimposed. This type of loading resulted in symmetric shear-strain cycles which cause contraction and associated buildup of pore pressure. It is only the unidirectional monotonic shear strain which causes dilation. Hence, the fact that the symmetric cyclic tests reached 10 percent shear strain is not relevant (i.e., there is no "double counting" involved.

Response:

Comment noted. The information provided in the comment will be considered in Remedial Design but does not affect remedy selection.

Unique comment(s) addressed:

URSC02-12

Comment and Response: 23-17

Comment:

The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that Intalco relied upon plastic yielding and a constant modulus to account for material damping in the dynamic models as opposed to using hysteretic damping and a non-linear modulus. The Agencies had requested a reference for this methodology.

The comment also addressed the Agencies' comment that it was unclear how a model that relies on plastic yield or straining for cyclic damping also uses plastic yielding to dissipate pore pressures via the dilation model. The dilation model based on plastic strains seems like it could create a modeled cyclic resistance to liquefaction in addition to the resistance to liquefaction measured from cyclic laboratory tests. The deformation modeling techniques need to be further clarified in order for the Agencies to accept Intalco's reliance on these techniques during Remedial Design.

The commenter indicated the reference demonstrating the damping effect of the Mohr-Coulomb model under sever dynamic loading is

- *Roth, W.H., R.F. Scott, and P.A. Cundall. 1986. Nonlinear Analysis of a Centrifuge Model Embankment, 3rd National Conference EQ Engineering, Charleston, NC, August.*

The commenter also indicated the Mohr-Coulomb model was used with a non-associated flow rule with zero dilation angle, so the soil model did not dilate during plastic yielding. Thus, plastic yielding did not affect the soil's resistance to liquefaction or cause contraction or dilation in itself. Instead, excess pore pressures were generate empirically – independent of volume change – based on counting shear-stress cycles, and, where applicable, these pore pressures were then adjusted using the post-cycling-dilation scheme.

Response:

Comment noted. The information provided in the comment will be considered in Remedial Design but does not affect remedy selection.

Unique comment(s) addressed:

URSC02-13, URSC02-14

Comment and Response: 23-18

Comment:

The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that Intalco indicated that a low amplitude but long duration subduction zone earthquake event would be analyzed to determine if such an event is critical to seismic stability of the tailings piles, but the results of this analysis were not presented. The subduction record, scaled to match the design spectrum, should be checked as part of remedial design.

The commenter indicated the subduction record was analyzed and presented in the text of Appendix C of the Alternative 13M report. A subduction record was checked in initial modeling runs and was found not to govern the tailings pile performance. Therefore, it was not used in the final runs.

Response:
Comment noted. Thank you for the clarification. Note this did not affect remedy selection.

Unique comment(s) addressed:
URSC02-15

Comment and Response: 23-19

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that Intalco's assignment of tailings shear strength properties relied heavily on empirical correlations. However, Intalco's sensitivity analyses did not account for the potential error in the empirical correlations and only looked at the potential variability assuming the empirical correlations were correct. As a result these sensitivity analyses did not appear complete; however, the sensitivity analyses performed as part of the dynamic modeling appeared to indicate predicted deformations were relatively insensitive to the tailings static strength properties.

The commenter indicated that sensitivity analyses were performed to check lower than estimated tailings strengths above the water table, and were found to have little effect on the predicted deformation. The results of the sensitivity analyses are independent of how the strength properties were chosen (Standard Penetration Test correlations and laboratory test data were also considered when selecting tailings strength properties).

Response:
Comment noted. The information provided in the comment will be considered in Remedial Design but does not affect remedy selection.

Unique comment(s) addressed:
URSC02-16

Comment and Response: 23-20

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that the strength properties Intalco used to model the compacted tailings and alluvium appeared high and should be verified with tests and checked with sensitivity analysis during Remedial Design.

The commenter indicated the compacted tailings will primarily be derived from the outer shell of tailings that will be regraded; thus, a similar friction angle was modeled for the compacted tailings as was used for this outer shell. Intalco anticipates this could be achieved during construction. Appropriate quality control procedures will need to be established to verify the materials placed meet or exceed the design strength. Some laboratory tests were performed as part of the 2009 field program.

Response:
Comment noted. The information provided and referenced in the comment will be considered in Remedial Design but does not affect remedy selection.

Unique comment(s) addressed:
URSC02-21

Comment and Response: 23-21

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that Intalco used an assumed groundwater level for the analysis of waste rock pile stability and did not reference the groundwater level data from the vibrating wire piezometers installed during the summer of 2008. Measured groundwater levels should be used for Remedial Design. The comment noted that the Agencies have also commented this design should include sensitivity analyses for extreme groundwater levels, since design will likely be accomplished before much additional water level data has been obtained.

The commenter indicated the feasibility level design groundwater levels were based on information available at that time. Groundwater levels should be adjusted based on new information developed, if appropriate.

Response:
Comment noted. Note this issue did not affect remedy selection.

Unique comment(s) addressed:
URSC02-22

Comment and Response: 23-22

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) that the impacts of blasting the new creek channel in proximity to Tailings Pile 2 as part of the effort to relocate Railroad Creek must be considered during Remedial Design.

The commenter agrees evaluating the effects of construction procedures on site safety is an appropriate activity for Remedial Design.

Response:
Comment noted. This issue will be considered in Remedial Design but does not affect remedy selection.

Unique comment(s) addressed:
URSC02-23

Comment and Response: 23-23

Comment:
The Agencies previously commented (Forest Service 2010b) on the Alternative 13M report (ERM and URS 2009) to provide clarification regarding what the Agencies and Intalco agreed to for assessing the seismic deformation of the waste rock piles. The comment noted that based on the preliminary, simplified deformation analysis presented in a meeting between the Agencies and Intalco, the Agencies agreed that numerical deformation modeling analyses were not warranted for

the waste rock piles, but that simple deformation analyses are necessary to demonstrate seismic stability of proposed waste rock pile slopes.

The commenter accepted the Agencies clarification.

Response:
Comment noted.

Unique comment(s) addressed:
URSC02-24

<u>Comment and Response: 23-24</u>

Comment:
The Agencies previously commented (Forest Service 2010b) on the Draft Tailings and Waste Rock Pile Cover Evaluation and Selection report (the "cover report," ERM 2010b) that as a point of clarification Intalco did not have any analysis to predict how the tailings pile cap (cover as referred to by Intalco) would perform, as indicated in the cover report, but assumed the cover would behave like the underlying tailings and waste rock under seismic conditions. Additionally, the current geotechnical analyses did not address erosion, as stated in the cover report. Instead the Alternative 13M report (ERM and URS 2009) geotechnical appendix indicated erosion control would be considered during Remedial Design.

The commenter indicated the Agencies' characterization that Intalco assumed that the soil cover would behave like the underlying tailings and waste rock is incorrect. The comment said that Intalco assumed that the soil cover would perform at least as well as the underlying liquefied tailings in the event of a Maximum Design Earthquake. Some deformation of the tailings piles is anticipated from such an event, and the tailings piles would be regraded to their design slopes. As the soil cover is composed of a soil not subject to liquefaction, Intalco anticipates that the soil cover would simply move with the deforming tailings.

The commenter also indicated a separate deformation analysis of the soil cover for the Maximum Design Earthquake is not warranted for design. The design engineer may consider if it is needed to assess the impact of an Operating Basis Earthquake on the cap, based on a veneer stability analysis during Remedial Design.

Regarding cover erosion, the commenter indicated design of soil cover erosion control was not undertaken at the feasibility stage with the exception of soil benches that were included in the tailings regrading estimate. Erosion control provisions for pile runoff from a soil cover should be considered during Remedial Design.

Response:
Comment noted.

Though the commenter indicates the Agencies' characterization was incorrect, the comment appears to concur with the Agencies' previous comment that a deformation analysis was not performed for the cover analyses, and the cover was assumed to deform with the tailings and waste rock.

The Agencies agree a separate deformation analysis (i.e., numerical deformation model) for the cover is not warranted. During Remedial Design, seismic design of the cover should consider cover stability (i.e., factor of safety calculation) for the Operating Basis Earthquake and the Maximum Design Earthquake to satisfy ARARs, but that this is not needed for remedy selection.

The Agencies agree cover erosion control was not addressed in Intalco's feasibility level design, but this did not affect remedy selection and will need to be addressed as part of Remedial Design.

Unique comment(s) addressed:
ERMW07-30

Comment and Response: 23-25

Comment:
Several commenters had the following questions and comments during question and answer periods at public meetings:

a) *If you regrade the tailings it will produce a lot of material. Where is it going to go?*

b) *Is there a risk of making the stability of the tailings pile slopes worse as a result of regrading and, if so, perhaps they should be left as-is.*

c) *What type of failure are you talking about due to a seismic event? Slope failure? Half the tailings ending up down valley?*

d) *You must be very, very confident that reshaping the tailings is feasible and low risk, and I do not understand what the basis of that is.*

e) *Is one of the purposes of the buttress to contain sloughing if there is any during the excavation?*

Response:

a) As discussed in the final Feasibility Study and the Proposed Plan, the regraded tailings would be relocated to the tops of the tailings piles and/or compacted as part of the toe buttresses proposed for stabilizing the tailings piles in Alternatives 11M, 13M, and 14.

b) Additional geotechnical analyses of the stability of the tailings piles presented in the Final Feasibility Study generally indicated the tailings piles in their existing condition were only marginally stable and would not be stable during a seismic event. A slope failure could result in a significant release of reactive tailings to Railroad and Copper Creeks. For example, the DRI described analyses of a slope failure that would result in release of 3,000 cubic yards of tailings into Railroad Creek (the equivalent of about 240 three-axle dump trucks). These analyses were part of the basis for not considering an option that left the tailings piles in their current condition (with the exception of Alternative 12 No-Action). In addition to the analyses performed based on the existing conditions, analyses of tailings pile stability both for the static and dynamic cases and deformation analyses have been performed as detailed in the final Feasibility Study. These analyses demonstrated regrading combined with a toe buttress would result in considerable improvement of tailings pile stability over the existing conditions.

c) Based on the most recent analyses and the present day conditions in the tailings (e.g., lower groundwater levels than an operational tailings pile) it is likely that failure of the tailings piles during seismic shaking would release hundreds or thousands of cubic yards of tailings into the creek, not half the tailings piles as suggested in the comment. Flow in the creek would likely be impaired by this sudden dam, until it was overtopped and eroded, and then flow in the creek would convey these tailings downstream and into Lake Chelan. An estimated 600 cubic yards of tailings were released into Railroad Creek by erosion during flooding in the fall of 2003.

d) The Agencies are confident that regrading the tailings piles is feasible and can be accomplished in a low-risk manner, which will be evaluated during Remedial Design. Tailings piles are routinely regraded during mine closure (e.g., at the Cannon Mine in Wenatchee) or remediation (e.g., the White King Lucky Lass mine in Oregon).

e) The buttresses are intended to provide permanent stability for the tailings pile slopes by supporting the toe of the slopes. The potential for tailings releases during excavation and regrading will be mitigated via best management practices, including construction sequencing and temporary erosion control measures, and will be evaluated during Remedial Design.

Unique comment(s) addressed:
WPQA01-09

Comment and Response: 53-1

Comment:
The commenter supports Alternative 14 and states that the mine and tailings are not owned by Holden Village nor its direct responsibility, although Holden Village has spent much effort in trial attempts at seeding and limiting the harmful effects of the tailings piles.

Response:
Thank you for your support for Alternative 14. Holden Village owns patented mining claims within the Holden Mine Site, that include portions of the mine and the mill site, but not the tailings piles, which are on National Forest System lands. Holden Village is thus an owner/operator under both CERCLA and MTCA.

Unique comment(s) addressed:
RDJE01-01

Comment and Response: 53-2

Comment:
The commenter supports Alternative 14 and the expansion of hydroelectric power. The commenter urges the Agencies to work hard to encourage timely and effective communication between all parties.

Response:
The Selected Remedy includes the Agencies' stated preference for hydroelectric power. The development of new hydroelectric power sources and possible alternatives will be evaluated during Remedial Design.

Unique comment(s) addressed:
DGWI01-05

Comment and Response: 53-4

Comment:
The commenter inquired about who will be supervising the construction and what percentages of money are being covered by the mining company and the public.

Response:
The Agencies expect that Intalco will provide construction supervision, probably by using a hired engineering company. The Agencies' representatives will also observe construction to assure it satisfies requirements for the cleanup.

The Agencies expect Intalco to pay all the costs of remediation. The cost of the cleanup would not be at taxpayer's expense.

Unique comment(s) addressed:
HPQA01-05

Comment and Response: 53-5

Comment:
Commenter states that the cleanup is adjacent to the mine and inquired about the areas where the iron deposits have affected the creek bed a couple of miles downstream.

Response:
The majority of the cemented iron deposition (ferricrete) is within the vicinity of the tailings piles, although iron and other metals in a form referred to as "floc" have impacted the creek sediments downstream, and have been observed the entire way to Lucerne. The remedy will eliminate the effect of ferricrete from the aquatic environment, by relocating the affected portion of the channel, and groundwater barrier walls will cut off the flow of contaminated groundwater that causes formation of ferricrete and floc in the stream channel. Once the remedy is fully implemented, the quality of the stream sediment will improve through natural erosion and sediment transport and the quality of aquatic life will improve.

Unique comment(s) addressed:
CPQA01-06

Comment and Response: 53-7

Comment:
The commenter urges the Agencies to approach the many decisions remaining to be made with an open mind and recognition all parties are acting in good faith.

The length of this process has resulted in Intalco and the Agencies developing polarized views and positions. In the commenter's opinion, a lack of trust and drift toward extreme positions has been a problem.

The comment writer notes that Holden Village looks forward to actively coordinating and cooperating with Intalco and the Agencies to address these issues in the remedy design process and during remedy construction and operation.

Response:
The Agencies are and will continue working together with Intalco during Remedial Design, implementation, and monitoring, including coordination with and consideration of Holden Village.

Unique comment(s) addressed:
HVWC01-13

Comment and Response: 53-10

Comment:
Commenter had heard there would potentially be mitigation that was done off site, not in Holden but elsewhere around Lake Chelan. Is that something that is on the table or is all the work going to be right in Holden?

Response:
The intent of the cleanup is to remedy conditions impacted by releases from the mine within Railroad Creek valley. If remediation results in unavoidable impacts (e.g., to wetlands), mitigation will be required. Mitigation in the area of impact is preferred over off-site mitigation. Mitigation requirements will be determined by the Agencies as necessary.

Separate from the cleanup process addressed by this decision, designated natural resource trustees (the Forest Service, U.S. Fish & Wildlife Service, State of Washington, and Yakama Nation) intend to resolve liability for natural resource damages at the Holden Mine Site. This resolution may involve both on-site and off-site mitigation projects. No decisions in this regard have been made at this point. A public process will accompany any such decisions in the future.

Unique comment(s) addressed:
WPQA01-18

Comment and Response: 53-11

Comment:
The commenter is concerned about follow-up maintenance work. Some things Holden Village can take care of and some things will need professionals to come in and do. Is there some plan in place regarding the follow-up and maintenance work?

Response:
Intalco is expected to manage long-term remedy operations and maintenance, including providing the staff needed. While it is possible Intalco will want to work with Holden Village to provide accommodations for operations and maintenance staff, there are other alternatives that could be considered.

The number of maintenance and operations staff, either full-time or part-time needed for specific parts of the remedy will be determined during Remedial Design.

Unique comment(s) addressed:
WPQA01-17

Comment and Response: 53-12

Comment:
Commenter suggests the use of gravel or concrete and avoiding asphalt in places where caps are needed or along roadways. The concrete should be designed to withstand the environment and routine recurring use and abuse.

Response:
The Agencies do not anticipate that asphalt would be used for capping hazardous materials or for roadways as part of the cleanup. The remedy requires that a cap be constructed over the waste rock and tailings piles to reduce exposure to terrestrial organisms. Although design of this cap is not complete it will probably include soil planted with native vegetation. A cap will also be used to isolate contaminated soils in the Maintenance Yard, and here the cap may consist of concrete, or an impermeable membrane protected by gravel, so that Holden Village may continue to use the Maintenance Yard after remedy implementation. Paved roads are not anticipated as part of the remedy. Cap design will be completed as part of the remedial design.

Unique comment(s) addressed:
MSCH01-07

Comment and Response: 53-13

Comment:
Commenter suggests reclaiming the mine by putting the tailings back into the mine. Is it really cost prohibitive to do that? Are we sure there is room to regrade the tailings and place excess materials on top of the tailings piles?"

Response:
Intalco and the Agencies considered putting the tailings into the mine during the process of looking at options as part of the Feasibility Study and concluded this was not practicable. Additionally, there are significant hazards within the mine that would have to be addressed before entry into portions of the mine could be an option.

The proximity of the tailings piles to the creek is an important factor in evaluating feasibility of slope regrading. The final Feasibility Study indicates there is adequate room for disposal of excess tailings from the regrading, along with impacted soils from some other areas of the Site to be placed on top of the tailings piles prior to capping.

Unique comment(s) addressed:
HPQA01-04

Comment and Response: 66-1

Comment:
The commenter suggested that regrading slopes (and the need to then replant and reforest the slopes) would cause more environmental damage than what already exists.

Response:
Regrading the slopes to make them flatter will make them more stable during an earthquake. In combination, regrading and capping will also eliminate risk of erosion from transporting tailings into Railroad Creek. The steep slopes of the tailings piles currently support only limited vegetation. Although regrading will eliminate existing vegetation on the tailings piles, the decreased angle of the side slopes will allow vegetation to grow over a greater area and prevent erosion. The net effect will be more protective of the environment than if the Selected Remedy was not accomplished.

The proximity of the tailings piles to Railroad and Copper Creeks is an important factor in elimination of risk to human health and the environment. The final Feasibility Study included consideration of long-term problems including channel migration, potential stream bank erosion and scour, as well as access for: slope regrading, capping, buttress construction, and possibly ground improvement (construction measures to increase the density and or shear strength of the subgrade *in situ*, as suggested by Intalco), and post construction maintenance and monitoring. These are all (or in the case of ground improvement, may be) necessary parts of the cleanup.

Unique comment(s) addressed: POLS01-03

Comment and Response: 66-2

Comment:
How high will the tailings piles be after regrading? They are pretty high now.

Response:
The height of Tailings Pile 2 (the highest existing tailings pile) is not anticipated to change during remedy implementation. The height of Tailings Piles 1 and/or 3 is likely to increase, but will be determined during the design phase of remedy implementation.

Unique comment(s) addressed:
RGID01-02

Comment and Response: 66-3

Comment:
From the Proposed Plan, I do not understand what you do with what there is when you cut back the waste rock piles.

Response:
Regrading the waste rock pile slopes will result in making those slopes flatter and, therefore, more stable during an earthquake. Excess rock generated from regrading (flattening the slopes) will be relocated onto the tailings piles and, possibly, the former Mill Building foundation, prior to capping. After regrading, the tailings piles and the East and West Waste Rock Piles (potentially including impacted soils consolidated from other areas of the Site) would be capped.

Unique comment(s) addressed:
RGID01-03

Comment and Response: 66-4

Comment:
Anytime you disturb those tailings, you are going to create more dust. I will guarantee it.

Response:
Control of dust is an important issue in remedial construction, and active dust monitoring and mitigation will be required during all ground-disturbing activity at the Site. Dust control measures to protect human health and the environment will be developed during the Remedial Design phase of the remedy implementation.

Unique comments addressed
WPQA01-11

Comment and Response: 66-5

Comment:
Figure 12 (of the Proposed Plan) should include a note stating that depictions of the areas for moving the toe of the tailings are approximate and the final areas and locations will be determined during Remedial Design.

Response:
The Agencies agree; Figure 18 of the ROD indicates the anticipated limits of the Railroad Creek realignment and regrading slopes of the tailings piles will be determined during Remedial Design. Areas in which the toe of the tailing piles will be moved will be finalized during Remedial Design.

Unique comment(s) addressed:
INTA01-42

Comment and Response: 66-6

Comment:
The tailings buttress construction approach presented in the Proposed Plan has several disadvantages: a) risk of slope failure during construction; b) increased quantity of rock required; and c) requires Railroad Creek to be relocated.

Response:
During preparation of the final Feasibility Study, Intalco presented extensive calculations that showed stabilization of the tailing piles would require construction of large earthen buttresses that, by Intalco's own analyses, would require either creek relocation, and/or pulling back the toe of the tailings pile slopes. Buttress construction was described in the final Feasibility Study and the Proposed Plan for the purpose of evaluating feasibility for selecting a remedy. The final approach used for buttress construction will be determined during Remedial Design. This design is anticipated to include developing a construction sequence to reduce risk of slope failure during regrading, as well as optimization of the quantity of rock required.

The final Feasibility Study identified that where relocating the creek is possible relocation of Railroad Creek is more practicable and involves less risk than would moving the toe of the tailings piles away from Railroad Creek. Moving the toe of the tailings piles and/or creek relocation is needed to provide sufficient room for constructing the toe buttress needed for slope stability; as well as to serve other purposes, notably a) placement and long-term maintenance of riprap to protect the buttress from erosion and scour; b) construction of groundwater containment and collection components; and c) long-term maintenance and monitoring of the remedy.

Since Intalco has not shown the feasibility of buttress construction without moving either the creeks or the tailings pile slopes, there is no acceptable alternative to completing one or both of these as part of the remedy. However, because the distance between Tailings Piles 1 and 2 and Copper Creek is limited, the Agencies anticipate it will be necessary to move the toe of the tailings piles away from Copper Creek, depending on results of remedial design.

Unique comment(s) addressed:
INTA01-44

Comment and Response: 67-1

Comment:
The TEE shows a 1-foot cover to be protective.

Response:
Intalco has not presented information that shows the 12-inch cover proposed for the tailings and waste rock piles (URS 2010a) would be protective, or would satisfy the performance requirements for closure of limited purpose landfills [WAC 173-350-400(3)(e)(i)] which is the primary ARAR for capping the tailings and waste rock piles at the Site.

The TEE prepared by Intalco did not adequately address risk of the tailings to terrestrial receptors, as discussed in Agency comments on the TEE. Further, the TEE did not address cap performance that affects protectiveness, including root penetration and metals uptake, and the effects of bioturbation.

Although 2 feet of soil were used for cost estimating purposes for Alternative 14, as discussed in the SFS and the ASFS, the design of caps for waste rock, tailings, and any impacted soils or waste materials left in place will need to be completed during Remedial Design.

Unique comment(s) addressed:
TGAR01-57d

Comment and Response: 67-2

Comment:
The criteria for caps in Appendix C of the ASFS are inappropriate.

- *Appendix C of the ASFS does not specify the areas to which the performance objectives apply, although the introduction to Appendix C suggests that they apply to the tailings and waste rock piles in addition to the provisions of the limited purpose landfill regulations.*
- *Appendix C identifies supposedly "potentially relevant and appropriate" regulations and uses them to derive additional performance requirements that are not contained in the regulations themselves. These ad hoc performance criteria are not regulations and should not be considered ARARs at the site.*
- *The Appendix C criteria misapply the regulations cited. For example, the Agencies cite WAC 173-340-7491(1) to be potentially relevant and appropriate. The provision in WAC 173-340-7491(1) sets forth circumstances in which "no terrestrial ecological evaluation is required." These provisions do not purport to set forth criteria for protectiveness. Reliance on WAC 173-340-7491(1) to derive cap criteria is misplaced; these criteria set forth circumstances in which no terrestrial ecological evaluation is required, they do not set criteria for protectiveness.*

Response:
Appendix C specifically addresses caps needed to reduce risk to human health and ecological receptors, and to comply with ARARs in the area referred to as the Maintenance Yard, and potentially to other areas of the Site. The Selected Remedy includes capping the tailings and waste rock piles to conform with ARARs, including the Limited Purpose Landfills (LPL) regulations, which are relevant and appropriate. The LPL regulations allow for alternative cap designs that meet the performance standards (WAC 173-350-400).

Many of the remedy selection components under CERCLA and MTCA [i.e., the requirements presented in 40 C.F.R. § 300.430(e)(9)(iii) and WAC 173-340-360(2)] can be used to assess the degree to which a proposed cap would satisfy the basic requirement of protecting human health and the environment. The Agencies disagree with the assertion that these requirements are ad hoc or should not be considered ARARs.

The Agencies concur that WAC 173-340-7491(1) sets forth circumstances in which "no terrestrial ecological evaluation is required," but maintain that this exclusion only arises from circumstances (all impacted soils are below the point of compliance or are protected by physical barriers that prevent exposure of plants or wildlife) that are in fact protective. The conditions cited in WAC 173-340-7491(1)(a) and (1)(b) are relevant and appropriate to determining whether a cap is protective.

Unique comment(s) addressed:
TGAR01-57, TGAR01-57a, TGAR01-57b, TGAR01-57c

Comment and Response: 67-6

Comment:
A 2-foot cover would require additional time and scarce materials to implement and would be unnecessarily costly.

Response:
A 2-foot-thick soil cover was used for the specific purpose of cost estimating. The final Feasibility Study indicates that design details of caps (including the thickness) will need to be determined during Remedial Design. The effects of the time and amount of materials needed for cap construction and cost may be considered in comparing alternative cap designs that satisfy the threshold requirements under MTCA and CERCLA.

Unique comment(s) addressed:
INTA01-34

Comment and Response: 67-7

Comment:
I'm not sure what the nature of the cap is. Do you wipe everything out and put some physical barrier to isolate and then revegetate or is the disturbance to the existing vegetation limited to the areas of regrading?

Response:
Cap construction will eliminate the existing vegetation. Cap construction will include a cover with clean soil and replanting with native vegetation.

Unique comment(s) addressed:
WPQA01-06

Comment and Response: 67-8

Comment:
Intalco is concerned the Agencies may require a geomembrane liner or equivalent layer as part of the cover based on information in the ASFS. Intalco requests that the Agencies clearly state that although the cover design is not yet finalized, they will not require a liner or similar low permeability layer to be included.

Response:
The Selected Remedy will need to satisfy ARARs and be protective of human health and the environment. Details of the cap will be determined as part of Remedial Design. The Agencies would prefer not to have a cap that includes a geomembrane if the cap is otherwise protective of human health and the environment.

Unique comment(s) addressed:
MWHA01-56

Comment and Response: 67-9

Comment:

It is not clear that the full extent of groundwater dynamics has been captured at the Site. Consider capping at least Tailings Pile 1 with a geomembrane, clay, gunite, or shotcrete to limit infiltration and generation of leachate requiring treatment.

Response:

The final Feasibility Study described performance criteria that must be satisfied in designing and implementing caps for the tailings and waste rock piles. Although the final Feasibility Study did not rule out a geomembrane, clay, gunite, or shotcrete as part of a cap, neither did it find any reason to specify such components as part of the Selected Remedy. The use of a relatively more permeable cap would result in increased infiltration and, therefore, increase the amount of water to be collected for treatment, increasing the cost of treatment. The Agencies will review Intalco's cap designs and evaluate cap performance to satisfy ARARs and to protect human health and the environment.

Unique comment(s) addressed:

NPEC01-06

Comment and Response: 67-10

Comment:

The commenter referred to the Agencies' comments (Forest Service 2010b) on Intalco's Draft Tailings and Waste Rock Pile Cover Evaluation and selection Report (ERM 2010b) that noted that native vegetation observed growing on the tailings piles suggests that over time the root systems create soil conditions favorable to reestablishment of native shrubs and trees. The Agencies had questioned the assumption that over time the tailings piles would become acceptable habitat for terrestrial receptors (i.e., without capping). The commenter explained that recruitment and decomposition of early succession plants would provide organic material and nutrients promoting later colonization by shrubs and trees. Data collected by Intalco show the total organic carbon content is currently too low on portions of tailings and waste rock piles.

Response:

The Agencies do not accept the premise that no action is needed to enable the tailings piles to support native vegetation within a reasonable restoration time frame. The Agencies expect cap design will be accomplished as part of remedial design to optimize revegetation of the tailings (and waste rock pile) caps while being protective of human health and the environment.

Unique comment(s) addressed:

ERMW07-28

Comment and Response: 67-11

Comment:

Honeymoon Heights Waste Rock Piles were not addressed because neither Alternatives 13M nor 14 propose covers for these piles.

Response:
The Agencies' Alternative 11M included removal of the Honeymoon Heights Waste Rock Piles to eliminate risk to humans and terrestrial receptors. As described in the ASFS and the Proposed Plan, the Agencies determined that Alternative 14 would adequately eliminate risk from the Honeymoon Heights Waste Rock Piles, with less overall adverse environmental impact compared to Alternative 11M, and that Alternative 13M did nothing to eliminate these risks. The Selected Remedy includes institutional controls and *in situ* treatment that is anticipated to eliminate the risk to human health and terrestrial receptors, respectively, from hazardous substances being released from the Honeymoon Heights Waste Rock Piles.

Unique comment(s) addressed:
ERMW07-03

Comment and Response: 67-12

Comment:
The commenter referred to the Agencies' comments (Forest Service 2010b) on Intalco's Draft Tailings and Waste Rock Pile Cover Evaluation and Selection Report (ERM 2010b) that noted that, during final design, Intalco will need to demonstrate that the proposed cap prevents or minimizes infiltration to prevent generation of significant quantities of groundwater with hazardous substances. The comment noted that Alternative 13M included regrading and covers for the tailings piles that will reduce infiltration. Additional evaluation of cover configurations would be conducted during design. Further, the comment noted that Alternative 13M included collection and treatment of groundwater with concentrations above ARARs at designated points of compliance prior to discharge to Railroad Creek.

Response:
The Agencies appreciate the clarification but note that Alternative 13M does not include collection and treatment of all impacted groundwater with concentrations of hazardous substances above cleanup levels. Specifically, Alternative 13M does not contain impacted groundwater beneath Tailings Piles 2 and 3 that is hydraulically connected with Railroad Creek.

Unique comment(s) addressed:
ERMW07-06

Comment and Response: 67-13

Comment:
Figure 12 of the Proposed Plan shows a 2-foot-thick cap with a geomembrane. This is inconsistent with page 79 that indicates a geomembrane will not be required. Also the 2-foot cap should be changed to "cover" since a thinner cover will meet the Agencies' performance requirements.

Response:
Figure 12 of the Proposed Plan illustrates principal components of Alternative 11M. The Selected Remedy (which is based on Alternative 14, not Alternative 11M) does not specify the use of a geomembrane as part of the cap for the tailings and waste rock piles. The Selected Remedy, as described in the ROD, includes capping the tailings piles and waste rock piles to satisfy performance requirements specified in the ARARs and to protect human health and the

environment. There is flexibility with respect to the cap components that meet ARARs and protect human health and the environment.

Unique comment(s) addressed:
INTA01-33

Comment and Response: 67-14

Comment:
The commenter referred to the Agencies' comments (Forest Service 2010b) on Intalco's Draft Tailings and Waste Rock Pile Cover Evaluation and selection Report (ERM 2010b) that noted that there was no basis to support Intalco's assertion in footnotes 6 and 24 of the draft TEE that there was no risk to herbivorous wildlife at the tailings and waste rock piles and, thus, subsequent recolonization (sic) by deeper-rooted shrubs and trees would be a supported natural by-product of initial revegetation. The comment said the footnotes were intended to suggest that, based on Intalco's analyses, ingestion of deeper-rooted plants alone does not pose risk to wildlife.

Response:
Intalco's TEE was flawed as discussed in comments by the Agencies (Forest Service 2009). Capping the tailings piles is needed to protect terrestrial receptors, and to comply with ARARs. The cap will eliminate the risk of tailings dispersion from wind and water erosion, prevent human contact with the wastes, and eliminate unacceptable risk to terrestrial receptors.

Unique comment(s) addressed:
ERMW07-29

Comment and Response: 67-15

Comment:
The commenter referred to the Agencies' comments (Forest Service 2010b) on Intalco's Draft Tailings and Waste Rock Pile Cover Evaluation and Selection Report (ERM 2010b) that discussed the seed mix used in some reforestation projects (Dodson and Peterson 2009). The comment writer noted that although the seed mix for Holden may be different, the plants will have similar attributes/phenotypes. Dodson and Peterson (2009) presented similar forest habitat and location and peer reviewed studies.

Response:
The Agencies appreciate the comment. Selection of native species to be established on the caps of the tailings and waste rock piles will be determined as part of Remedial Design. Specifications of an appropriate seed mix and the corresponding plant attributes/phenotypes will be determined during Remedial Design and, in part, based on final cap design and soil specifications.

Unique comment(s) addressed:
ERMW07-25

Comment and Response: 67-16

Comment:

The commenter referred to the Agencies' comments (Forest Service 2010b) on Intalco's Draft Tailings and Waste Rock Pile Cover Evaluation and selection Report (ERM 2010b) that Intalco inferred that shrubs and trees would re-establish on the tailings and waste rock piles with a 12-inch cover, based on observations of eastside mixed conifer forest associated plants in the Wind-Blown Tailings Area. The Agencies had noted the data referenced do not support Intalco's comparison of an established eastside mixed conifer forest impacted by near-surface accumulations of windblown tailings and the goal of re-establishing similar habitat over the tailings piles using a 12-inch soil cover. The comment indicated the Wind-Blown Tailings Area was referred to only as a point of reference for the vegetation types expected to establish on the tailings and waste rock piles over time.

Response:

The test plot areas and wind-blown tailings could be used to infer the types of grasses and forbs likely to re-establish on the tailings and waste rock piles. However, the data referenced do not support the inference that following recolonization of grasses and forbs; taller shrubs, huckleberry, willow, and coniferous trees would also re-establish on the tailings and waste rock piles. Additional data will need to be developed during Remedial Design to support this inference, and the cap must be protective of human health and the environment.

Unique comment(s) addressed:

ERMW07-27

Comment and Response: 67-17

Comment:

Installation of jute mat (pinned in) on regraded tailings slopes should be strongly considered prior to placing soil cap and revegetating to improve stability until plant roots are established.

Response:

Comment noted. The potential use of a jute mat to help promote stability until planting roots are established may be evaluated during the design phase of remedy implementation.

Unique comment(s) addressed:

NPEC01-08

Comment and Response: 68-1

Comment:

Several comments assert that a 1-foot thick cover (used in Alternative 13M) will meet performance criteria and satisfy both MTCA and CERCLA. These comments are summarized as follows:

- *A 1-foot cover meets the state limited purpose landfill requirements.*
- *A 1-foot cover meets CERCLA and MTCA selection criteria (greater short-term effectiveness, lower cost, more implementable).*

- *Reiteration that Holden studies support 1-foot cover. Agencies do not provide scientific evidence demonstrating a 2-foot cover would be substantially more effective.*

- *Details during design. Information in Intalco's Cover Report (ERM 2010b) supports selection of a 1-foot cover. "Optimal" cover is the thinnest that meets ARARs.*

- *A 1-foot cover would satisfy State performance requirements and Forest Plan Standards and Guidelines as demonstrated by Intalco's TEE. See responses to Agencies' cover comments and comments on Alt. 14.*

- *A 1-foot cover should be selected as the preferred remedy instead of a 2-foot cover because the thinner cover would: a) protect terrestrial ecological receptors and comply with ARARs as well as the thicker cover; b) provide equal long-term effectiveness and permanence; c) reduce the mobility of hazardous substances to the same extent; d) provide better short-term effectiveness; e) be more implementable; f) cost less; g) allow equally effective monitoring; and h) be equally acceptable to the state and public.*

Response:
The Agencies comments on Intalco's proposed cap for tailings and waste rock piles (Forest Service 2010b) concluded that Intalco has not demonstrated that either a 1-foot-thick cap or the cap Intalco previously proposed under Alternative 13M (6 inches of soil/gravel and wood slash on the top surfaces and 8 to 12 inches of soil/gravel placed on the side slopes) would be protective or satisfy the state's performance requirements for capping limited-purpose landfills (WAC 173-350-400). Intalco has not demonstrated that such a cover would satisfy either the performance requirements for landfill covers or the Forest Plan Standards and Guidelines (Forest Service 1990). The Agencies concluded that based on available information, this component of Alternative 13M could not be included as part of a selected remedy.

Unique comment(s) addressed:
INTA01-35, INTA01-36, ERMW07-21, ERMW07-23, ERMW03-02, ERMW03-03, ERM01-03

<u>Comment and Response: 68-2</u>

Comment:
The same animals that would burrow below a 1-foot cover on the tailings piles would also burrow below a 2-foot cover, except the badger and carpenter ant. Intalco's TEE found there is no risk to burrowing animals compared to background (with possible exception of the vole).

Response:
The Agencies have not concluded that a 2-foot-thick cover would necessarily satisfy ARARs or be protective of terrestrial receptors. A 2-foot soil cap was used for cost comparison purposes only, and the final Feasibility Study specifically noted this. The ROD specifies that the Selected Remedy will need to include a cap that is designed to be protective and to satisfy ARARs such as the state's Limited Purpose Landfill requirements [WAC 173-350-400(3)(e)(i)].

Unique comment(s) addressed:
ERMW07-13

Comment and Response: 68-3 and 68-6

Comment:

Several comments identified case histories that the commenter indicated provide useful and appropriate information for sites with similar RAOs, exposure pathways, and COCs, and indicate that an acceptable cover thickness is within the 8- to 12-inch range.

Based on the draft TEE, both Intalco and Agencies propose the cap for the tailings and waste rock piles consist of a soil cover, the only difference is 1 foot vs. 2 feet of' cover. The Agencies have not provided scientific evidence that a 2-foot-thick cap cover would be more effective than a 1-foot-thick cover.

Sites reviewed have similar RAOs and PCOCs. See attached Table CVR-12. These case studies demonstrate that the Forest Service allows use of covers from 8 to 12 inches thick. Azurite has a 24-inch cover, but 12 inches of gravel is only for erosion control since it is not revegetated.

Response:

The commenters' summary of precedents for similar sites in Washington is incomplete, and does not adequately inform decision-making for selection of a remedy for the Holden Site. The comments omitted or inadequately characterized some of the details cited (e.g., cap thickness at Azurite; the fact that the cap at Beth's Lake was for an interim action, not a final remedy; the recommended remedy for the Longshot Mine did not rely on the cap described; and the Administrative Record for the Oriole mine determined that further studies are needed).

The commenter is mistaken in stating that the TEE provides a basis for anticipating that the only difference in Alternative 13M and the Selected Alternative (based on Alterative 14) cap for the tailings and waste rock piles is only the difference of 1 foot vs. 2 feet of cover. The Selected Alternative requires that the final cap be designed to be protective and to satisfy ARARs, and the ROD notes that a 2-foot-thick cap was used in the ASFS only for cost estimating purposes.

Intalco has not presented information that shows that the 6-inch cover of soil/gravel and wood slash proposed for the tailings and waste rock piles (ERM 2010b) or the 12-inch cover discussed in URS (2010a) would be protective or would satisfy ARARs, (e.g., the performance requirements for closure of limited purpose landfills [WAC 173-350-400(3)(e)(i)] which is the primary ARAR for capping the tailings and waste rock piles at the Site).

Unique comment(s) addressed:

ERMW07-20, ERMW07-19, ERMW07-11, ERMW07-15
L:\Jobs\476916\Response to Comments\Responsiveness Summary 1-25-12.doc

Comment and Response: 68-4 and 68-5

Comment:

One commenter referred to the Agencies' comments (Forest Service 2010b) on Intalco's Draft Tailings and Waste Rock Pile Cover Evaluation and Selection Report (ERM 2010b) that questioned Intalco's suggestion that a 12-inch-thick cap would prevent deeper-rooted plants (e.g., trees and shrubs) from being exposed to tailings and waste rock with metals concentrations above risk-based protection levels, and that this would not satisfy ARARs or the RAOs for the Site. The comment *provided references that show that a 12-inch cover would sustain shallow-rooted vegetation, and that the large number of native shrubs and trees present on the tailings piles suggests that metals concentrations are not preventing the establishment of native deeper-rooted plants under current conditions.*

Related comments stated that based on the information provided, there is no scientific evidence to suggest a two-foot-thick cap is more protective or effective than a one-foot-thick cap in establishing eastside mixed conifer habitat. One Agency comment noted that the cover report does not assert re-establishment of vegetation indicates absence of risk. Observed establishment of healthy shallow and deep-rooted plants indicates eastside mixed conifer forest will re-establish with a 1-foot cover in accordance with WAC 173-350-400(3)(e)(i)(D).

Response:
The presence of some trees and shrubs on the tailings piles does not indicate that the tailings are able to support vegetation to the same degree that an uncontaminated site would. The cover report claims that the tailings piles and East and West Waste Rock Piles pose no risk to mammals and minimal risk to soil invertebrates is based on Intalco's flawed TEE. In addition to risks to plants, Table 14 of the ASFS shows that hazardous substance concentrations in the tailings piles and waste rock piles exceed risk-based concentrations for the protection of invertebrates and wildlife. Intalco's cover report also does not address burrowing depths of mammals and invertebrates with respect to the cover thickness (see Appendix C of the ASFS). The report also does not address other important considerations such as bioturbation from roots, transport of COCs to surface through new growth, evidence of elevated metals in organisms, etc. Finally, the Agencies have not asserted that a 2-foot-thick cap is protective or would comply with ARARs; rather it was used to estimate costs.

Unique comment(s) addressed:
ERMW07-24, ERMW07-07, ERMW07-10

Comment and Response: 68-7 and 68-8

Comment:
One commenter referred to the Agencies' comments (Forest Service 2010b) on Intalco's Draft Tailings and Waste Rock Pile Cover Evaluation and selection Report (ERM 2010b) that discussed the final cover constructed as part of a time critical removal action at the Beth Lake Prospect. The comment noted that human health, ecological risks, and risks to surface water were the basis for the removal action which included a cap on a waste rock pile. Some constituent concentrations were greater than ecological protection criteria by factors of two to seven for various hazardous substances, and two times greater than background. Though the cap was constructed as part of a time-critical removal action, the commenter noted that no further action is planned at that Site.

Other comments referred to the Agencies' comments (Forest Service 2010b) on Intalco's Draft Tailings and Waste Rock Pile Cover Evaluation and selection Report (ERM 2010b) that discussed remedial actions at the Longshot and Oriole mine sites.

- *At the Longshot Mine, the remedy included a 10-inch earthen cover over waste rock placed in an abandoned mine stope. The comment noted that this 10-inch cover was intended to meet state solid waste requirements (WAC 173-350-400).*

- *At the Oriole Mine, soil cover was laced over waste rock to control ecological exposure to hot spots and promote revegetation. The comment noted that a data gap analysis remained to be completed, to determine whether additional cap measures (described as an engineered soil or impermeable cover) is needed. The additional analysis would be designed using "an appropriate infiltration model such as HELP, HYDRUS, EPACML, or CHEMFLO." The comment noted that a HELP analysis had been completed by Intalco at Holden, and that this demonstrated the effectiveness of a vegetated cap to adequately control infiltration, and the final cover configuration would be developed during Remedial Design.*

Response:
The comment does not provide any new information to substantiate why design of the waste rock cap at Beth Lake Prospect or Longshot Mine is relevant to the Holden Site. The time-critical removal action at Beth Lake Prospect addressed a relatively small (645 bank cubic yards) waste rock pile under circumstances that were quite different from Holden. The remedy for Longshot included isolation of the waste rock from the terrestrial environment by placement in the mine workings, and a barrier to prevent human access. Thus, although cleanup actions at both of these sites were developed in accordance with CERCLA and the NCP, there is no reason why the remedy at either of these sites would necessarily be the same as the remedy at Holden.

The comment on the Oriole Mine describes a process that is incomplete, i.e., the results of the additional analysis and the suitability of the interim 12-inch cap are not yet known.

Also, although Intalco did complete HELP analyses as part of the RI/FS, the application of these results to cap design will need to be presented as part of remedial design.

Unique comment(s) addressed:
ERMW07-16, ERMW07-17, ERMW07-18

Comment and Response: 69-1

Comment:
The cost to implement a contingent barrier wall could be much higher than estimated $12M. It is not possible to accurately predict the cost, duration, and effectiveness of the contingent barrier wall.

Response:
The commenter is mistaken in referring to the Phase 2 groundwater barrier as the "contingent barrier wall." The Selected Remedy requires installation of the Phase 2 groundwater barrier; though it is possible the Selected Remedy could be modified as discussed in the ROD.

The Agencies' cost estimate for the barrier wall is based on estimated costs provided by Intalco, modified as discussed in Appendix A of the ASFS. The Agencies modified Intalco's barrier wall costs by modifying the length of the barrier, but did not change the unit costs presented by Intalco.

EPA guidance for feasibility study cost estimates (EPA 2000) provides different contingency factors for different types of remedial activity, and suggests weighting factors for typical cost elements included in a proposed cleanup action. While contingencies are typically considered as an allowance for unanticipated cost increases, there is also a potential for cost reductions from anticipated or unanticipated circumstances.

Unique comment(s) addressed:
MWHA01-26

<u>Comment and Response: 69-2</u>

Comment:
The cost of the Tailings Piles 2 and 3 (Phase 2) barrier wall is not warranted given negligible risk reduction and limited environmental benefit. Mass loading from major sources will be contained and collected without this barrier. The barrier wall will be installed to prevent drinking water quality groundwater from entering Railroad Creek with no additional environmental benefit.

Response:
Without the Tailings Pile 2 and 3 groundwater barrier, contaminated groundwater from beneath the tailings piles would continue to discharge untreated into Railroad Creek, and groundwater above MCLs would not be contained within a WMA. As illustrated in Table 7 of the ROD, groundwater below Tailings Piles 2 and 3 exceeds drinking water standards for aluminum, cadmium, copper, lead, and zinc. Tailings Piles 2 and 3 are significant sources of hazardous substances released to the environment, even though the commenter does not consider them to be major sources. Figure 8 of the ROD shows that groundwater beneath Tailings Piles 2 and 3 significantly exceeds proposed cleanup levels for protection of aquatic life, e.g., seasonal concentrations of hazardous substances range between 200 and 41,000 times the levels that are protective of aquatic receptors.

The cost of the barrier wall is relevant to comparing the relative merits of two or more permanent remedy alternatives that each satisfy the threshold criteria for remedy selection, protection of human health and the environment and compliance with ARARs. At this time, with respect to the contamination the Phase 2 barrier wall would address, there are no alternatives meeting the threshold criteria for comparison.

Unique comment(s) addressed:
MWHA01-21

<u>Comment and Response: 69-3</u>

Comment:
Several comments on barrier wall implementability are summarized as follows:

- *The barrier wall around Tailings Piles 2 and 3 may not be implementable. Challenges include large boulders, high groundwater levels, and limited working area. Requiring a fully penetrating wall exacerbates the challenges given the barrier wall depths, suitable equipment, and Site access. The Proposed Plan did not adequately discuss the challenges related to construction of the contingent barrier wall.*

- *There is a risk of trench collapse due to excavation depth and a potential tailings stability issue.*

- *Agencies have not provided any data that show the proposed barrier is reasonable. The barrier will be difficult to implement due to depth to bedrock or impermeable glacial till.*

Response:
The groundwater barrier wall that is included in the Selected Remedy is well within the depth and construction constraints (e.g., alluvial soils with boulders) that have routinely been addressed at other sites, as discussed in Appendix C of the SFS.

The Agencies concur that a limited working area may increase the difficulty of implementation, and see this as one of the major reasons why Railroad Creek must be relocated and/or the toe of the tailings piles moved back from the creek. A related issue is the need to maintain stability of the tailings piles in the event of trench stability problems, which can be addressed through design (e.g., setback distance and slope grade, limiting panel length) and construction quality control (maintaining adequate slurry level, slurry density, etc.).

Finally, the Agencies reject the comment that data have not been provided that show the Phase 2 barrier (incorrectly referred to as a contingency in the comment) is not reasonable. Without the Tailings Pile 2 and 3 groundwater barrier, contaminated groundwater from beneath the tailings piles would continue to discharge untreated into Railroad Creek, and groundwater above MCLs would not be contained within a WMA.

Unique comment(s) addressed:
MWHA01-10, MWHA01-23, TGAR01-26

<u>Comment and Response: 69-4</u>

Comment:
The habitat impacts from iron floc clearly indicate the benefit of moving Railroad Creek from the mid-point of TP-2 and along TP-3. Once iron floc creation has been controlled, the impacted portions of the creek will quickly recover to a condition similar to that found downstream from RM-7.

The contingent barrier wall is not needed for recovery of Railroad Creek. The main aquatic impacts are related to floc/ferricrete which will be addressed by measures other than the contingent wall. There are few impacts related to dissolved metals concentrations, as evidenced by the presence of spawning kokanee and by the fact that resident fish in Railroad Creek have adapted to present water quality.

Response:
The Selected Remedy includes relocating the portion of Railroad Creek impacted by ferricrete and as needed for implementation of the remedy, but creek relocation alone will not eliminate the formation of iron floc or reduce metals concentrations to levels that are protective of aquatic life. The comment suggests that observed spawning indicates there are few impacts from metals concentrations, but this ignores measured detrimental effects on species composition, abundance, and diversity. Further, the kokanee spawning is limited to a short reach of Railroad Creek between Lake Chelan and a natural barrier approximately 1.4 mile from Lake Chelan. The RI identified significant adverse impacts on populations of benthic macroinvertebrates in Railroad Creek, which

are a food source to salmonids as well as a good indicator of overall quality of the aquatic environment.

The Selected Remedy relies on source controls to eliminate risk of groundwater with high concentrations of hazardous substances from entering Railroad Creek. Without the Tailings Pile 2 and 3 groundwater barrier (incorrectly referred to in the comment as a contingent part of the remedy) contaminated groundwater from beneath the tailings piles would continue to discharge untreated into Railroad Creek, and groundwater above MCLs would not be contained within a WMA. Although the comment refers to conditions downstream of river mile seven (RM 7), the RI indicated that iron floc and concentrations of hazardous substances above cleanup levels persist all the way downstream to Lucerne.

Unique comment(s) addressed:
HVWC03-02, HVWC03-03

<u>Comment and Response: 69-5</u>

Comment:
The barrier wall around Tailings Piles 2 and 3 will make no discernable difference in water quality in Railroad Creek. Alternative 14 has four redundant measures to protect the creek from discharges adjacent to Tailings Piles 2 and 3: Railroad Creek is a losing creek, relocate creek, line the relocated creek, and the fully penetrating barrier wall that would prevent downgradient migration of contaminants above cleanup levels.

Response:
The Selected Remedy is based on available information that indicates a groundwater barrier wall is needed to contain groundwater impacted by releases from Tailings Piles 2 and 3 to protect aquatic life in Railroad Creek and to manage groundwater above MCLs within a WMA.

Although the comment refers to them as redundant measures, the four items noted are not duplicative.

- Available data suggest that Railroad Creek is in a losing condition adjacent to most of Tailings Piles 2 and 3. However, groundwater impacted by releases from the tailings piles enters Railroad Creek downstream of Tailings Pile 3, where the creek is in a gaining condition, at concentrations above cleanup levels; see Figure 9 of the ROD.
- Creek relocation would enable construction of the remedy with less tailings regrading than leaving the creek in place, but relocation to the extent discussed in the final Feasibility Study would not change the flow of groundwater into the creek downstream of Tailings Pile 3.
- Intalco proposed lining the relocated creek channel to prevent loss of clean water into the groundwater collection system it proposed for Alternative 13M (i.e., to reduce the volume of groundwater that would flow through the treatment system). Lining the relocated creek channel as discussed in the final Feasibility Study would not change the flow of groundwater into the creek downstream of Tailings Pile 3.
- The fully penetrating groundwater barrier that is part of the Selected Remedy would prevent downgradient migration of hazardous substances in groundwater, and prevent

groundwater concentrations above cleanup levels from entering Railroad Creek, and would provide containment of groundwater above MCLs within a WMA.

Unique comment(s) addressed:
MWHA01-09

Comment and Response: 69-6

Comment:
Construction of the Phase 2 barrier wall will take at least an entire season and could easily require a second. Large cost overruns, construction claims, schedule delays, and quality control issues are likely and could create a poor public image of Intalco and the Agencies. Contingencies for this need to be programmed into this remedy component.

Response:
Construction of the Phase 2 groundwater barrier wall could be accomplished using techniques such as staged construction of discrete barrier wall panels interconnected with secondary panels. This approach is common in slurry wall construction, and allows considerable flexibility in the rate of construction, with the opportunity to construct multiple panels concurrently at various locations along the barrier alignment. This would enable the construction schedule to be adjusted as dictated by subsurface conditions and other constraints. Intalco has considerable flexibility, under Agency oversight, to prepare construction plans that minimize the risk of cost overruns, claims, delays, and quality control problems. The Agencies concur that Intalco needs to be proactive in anticipating and preparing for contingencies that may arise during construction.

Unique comment(s) addressed:
MWHA01-24

Comment and Response: 69-7

Comment:
The extent of ongoing electric power demand depends on whether or not the east barrier wall is needed.

Response:
The Selected Remedy includes a groundwater barrier wall in the “east” area around Tailings Piles 2 and 3. Without the Tailings Pile 2 and 3 groundwater barrier, contaminated groundwater from beneath the tailings piles would continue to discharge untreated into Railroad Creek, and groundwater above MCLs would not be contained within a WMA. As a result, the Selected Remedy includes design of the groundwater treatment system and related infrastructure (including electric power) needed to handle the volume of groundwater that would be collected for treatment by the east area (or Phase 2) groundwater barrier.

Unique comment(s) addressed:
WGID02-04

Comment and Response: 69-8

Comment:

Several comments expressed concern regarding the reason a second barrier wall was needed and the time frame for making that decision. These are summarized as follows:

- *The Proposed Plan should articulate a technical rationale for why it makes sense to make this decision (the installation of a second barrier wall) after three years of monitoring or simply state that the Agencies have concluded the barrier is necessary and they want the delay in completing the remedy to be kept to a minimum.*
- *Stating that Intalco has not demonstrated aquatic life criteria will be met without the additional barrier is unconvincing since there has been no demonstration that these criteria would be met with the barrier.*
- *Since background concentrations exceed criteria for some metals at some times of year, there may be no measurable decrease in metals concentrations at the CPOC due to installation of the barrier.*

Response:

The Agencies have concluded that a groundwater barrier is needed around the LWA and Tailings Pile 1 (the Phase 1 barrier) as well as around Tailings Piles 2 and 3 (the Phase 2 barrier). The final Feasibility Study shows that contaminated groundwater from beneath the tailings piles and the LWA would continue to discharge untreated into Railroad Creek unless both a groundwater barrier and collection system are constructed.

During preparation of the Proposed Plan, as well as earlier during the feasibility studies, Holden Village expressed significant concerns for its continued viability if construction was accomplished in a single phase over several years. As a result, the Agencies determined it would be acceptable to postpone the second phase of construction for a period of not more than five years after the first phase, to provide a respite to the village. A decision point at 3 years after implementation of the Phase 1 barrier allows for 3 years of monitoring and then 2 years of evaluation and design. During the same period, Intalco conjectured that natural attenuation is sufficient to protect human health and the environment, and that additional monitoring would demonstrate this and show that the second phase groundwater barrier and collection system was not needed.

The ROD includes the provision that the barrier wall design could be modified or would not need to be installed, if demonstrated to satisfy ARARs and be protective within a timeframe comparable to the Selected Remedy. The second phase of the remedy may be eliminated only if it can be demonstrated to the Agencies' satisfaction that:

1. Groundwater concentrations are reduced to achieve surface water cleanup levels within groundwater before that portion of the hyporheic zone that supports aquatic life, including fish spawning and benthic macroinvertebrates; and
2. One of the following: a) groundwater meets MCLs below Tailings Piles 2 and 3, as well as throughout the plume; or b) groundwater that exceeds drinking water standards will be contained within a WMA; or c) an ARAR waiver for MCLs beneath Tailings Piles 2 and 3 based on technical impracticability from an engineering perspective is justified.

The comment is incorrect in stating that no demonstration has been made that aquatic life would be protected by construction of the groundwater barrier and collection system. Similar barrier walls have been successful in preventing migration of contaminated groundwater and protecting surface water at a large number of other sites, as discussed in detail in Appendix C of the SFS.

Background concentrations in Railroad Creek exceed aquatic life protection criteria for several constituents of concern: aluminum, cadmium, copper, lead, and zinc. Concentrations in Railroad Creek increase significantly above these background levels from releases from the Site; see Figure 12 of the ROD. As a result, the Agencies anticipate there will be a significant decrease in constituents of concern concentrations at the CPOC following installation of the barrier.

Unique comment(s) addressed:
HVWC02-14a, HVWC02-14b, HVWC02-14c

Comment and Response: 71-1

Comment:
One comment provided a response to the Agencies' prior comments (Forest Service 2010b) on Intalco's cost estimates for Alternatives 11 and 13M that were submitted by email on September 4, 2009, in support of the Alternative 13M Evaluation Report (ERM and URS, 2009) and discussed the 30-year period used for analysis of operations and maintenance (O&M) costs. The comment said that differences due to future equipment replacement costs would not significantly affect cost comparisons of different remedial alternatives. Although the total cost of both alternatives would be higher if a 50-year period was used, the effect of including future equipment replacement costs in total present worth cost would be insignificant to total.

Response:
The Agencies used a 50-year period because this more accurately reflects costs that are expected to continue for longer periods (hundreds of years) than does a 30-year period, as explained in Appendix B of the SFS. Further, it is necessary to include equipment replacement costs to evaluate the remedy selection criteria including: long-term effectiveness and permanence, implementability, and cost. (Intalco used a simple lump sum of $10,000 without discussing whether this would be adequate. The Agencies' more detailed analysis indicated this was too low for any alternative and that costs for individual alternatives differed significantly). The Agencies consider equipment replacement explicitly in their evaluations, including an estimate of equipment replacement costs for Alternative 13M, and concluded that the Selected Remedy does satisfy criteria for selection of a permanent remedy.

Unique comment(s) addressed:
URSC09-10

Comment and Response: 71-2

Comment:
One comment provided a response to the Agencies' prior comments (Forest Service 2010b) on Intalco's cost estimates for Alternatives 11 and 13M that were submitted by email on September 4, 2009, in support of the Alternative 13M Evaluation Report (ERM and URS, 2009) and noted

Intalco's estimate did not include any costs for regulatory agency review and oversight of treatment system operations. The comment said these cost may be assumed to be included in Intalco's 30 percent contingency for feasibility level costs, and noted that the Agencies did not include contingencies in their estimates.

Response:
The Agencies' cost estimates for the final Feasibility Study included all anticipated components of each remedial alternative based on experience at a number of other sites. In general, it is not good estimating practice to omit identified costs on the premise that such costs can be adequately considered by lumping them in with other (unspecified) contingent costs. The Agencies addressed contingency costs as discussed in Appendix B of the SFS and Appendix A of the ASFS.

Unique comment(s) addressed:
URSC09-11

Comment and Response: 71-3

Comment:
One comment provided a response to the Agencies' prior comments (Forest Service 2010b) on Intalco's cost estimates for Alternatives 11 and 13M that were submitted by email on September 4, 2009, in support of the Alternative 13M Evaluation Report (ERM and URS, 2009) that noted it was not clear what flow rates were used in Intalco's estimate of groundwater treatment system costs, and how treatment costs vary in relation to changes in flow rate. The commenter provided the flow rates that Intalco assumed for the Alternative 11 cost estimate and said the Alternative 13M flow rates were based on preliminary data available at the time of creating the cost estimate and were not revised to consider results of Intalco's subsequent groundwater modeling. The commenter stated that no significant impact to cost estimates is expected based on comparison of preliminary and final flow rates.

Response:
Thank you for the clarification. The comment does not provide any new information that affects remedy selection.

Unique comment(s) addressed:
URSC09-03

Comment and Response: 71-4

Comment:
One comment provided a response to the Agencies' prior comments (Forest Service 2010b) on Intalco's cost estimates for Alternatives 11 and 13M that were submitted by email on September 4, 2009, in support of the Alternative 13M Evaluation Report (ERM and URS, 2009) that questioned some of the assumptions for excavation for the groundwater treatment system. The commenter noted that Intalco assumed Alternative 13M would require excavation to lower the pond area by about 2 feet for suitable gravity flow, but said that Intalco was reevaluating whether lower overall costs would be feasible if a pumped system was used instead of gravity flow. The commenter also noted that excavations were needed for Alternative 11 to create benches on the moderately sloping hillside.

Response:
Thank you for the clarification. The comment does not provide any new information that affects remedy selection.

Unique comment(s) addressed:
URSC09-04

Comment and Response: 71-5

Comment:
One comment provided a response to the Agencies' prior comments (Forest Service 2010b) on Intalco's cost estimates for Alternatives 11 and 13M that were submitted by email on September 4, 2009 in support of the Alternative 13M Evaluation Report (ERM and URS, 2009) that questioned why Intalco assumed the treatment system ponds would be lined in the cost estimate for Alternatives 11, but assumed unlined ponds for Alternative 13M, a difference of more than $650,000. The commenter stated that Intalco's estimate included a lining for Alternative 11 because that was included by the Agencies in their estimate. However, Intalco did not believe a liner was necessary for Alternative 13M and so had not included that cost in their estimate. The comment noted that the Alternative 11 treatment system is in a location "relatively unaffected by past groundwater contamination," whereas Alternative 13M treatment system is in an area of "known past groundwater contamination." Finally the comment conjectured that unlined ponds in the East treatment area could potentially allow treatment of shallow groundwater seeping into the ponds in addition to water transferred to the ponds through the proposed collection systems.

Response:
The comment ignores ARARs that require the treatment system ponds to be lined to protect the environment. The comment mistakenly refers to *past* groundwater contamination without recognizing that groundwater contamination in both areas is an ongoing problem from uncontrolled releases of hazardous substances from the tailings piles and other mine area sources. Finally, neither the comment, nor other documents in the Administrative Record, supports Intalco's contention that groundwater seepage into an unlined pond would enhance groundwater quality.

Unique comment(s) addressed:
URSC09-05

Comment and Response: 71-6

Comment:
One comment provided a response to the Agencies' prior comments (Forest Service 2010b) on Intalco's cost estimates for Alternatives 11 and 13M that were submitted by email on September 4, 2009 in support of the Alternative 13M Evaluation Report (ERM and URS, 2009) that questioned why Intalco's cost estimate did not include the cost for removing sludge from the groundwater treatment system and transfer into a disposal facility. The commenter noted that Intalco assumed sludge would be dewatered in place by taking part of the treatment system off line during the summer months and then hauling the sludge to a disposal facility. The comment said this approach was based on reported sludge handling experience at the White King Lucky Lass Mine in Oregon. The comment also noted that sludge management is a significant design issue, and the ARARs affecting sludge management would be addressed later.

Response:
Thank you for the clarification. The comment does not provide any new information that affects remedy selection.

Unique comment(s) addressed:
URSC09-06

Comment and Response: 71-7

Comment:
One comment provided a response to the Agencies' prior comments (Forest Service 2010b) on Intalco's cost estimates for Alternatives 11 and 13M that were submitted by email on September 4, 2009, in support of the Alternative 13M Evaluation Report (ERM and URS, 2009) that noted Intalco's cost estimate for sludge management included something identified as a decant pond but did not explain what this was. The commenter explained that Intalco included a decant pond in its treatment system cost estimate because it considered it necessary for drying the sludge before disposal. The comment objected to the Agencies' description of sludge management for several reasons and provided additional technical information and opinions on sludge management that appear relevant to all of the remedial alternatives while recognizing that the volume of sludge produced will depend on the volume of contaminated groundwater that is collected and treated.

Response:
Thank you for the clarification. The issues discussed do not affect remedy selection, but will need to be further evaluated as part of Remedial Design.

Unique comment(s) addressed:
URSC09-07

Comment and Response: 71-8

Comment:
One comment provided a response to the Agencies' prior comments (Forest Service 2010b) on Intalco's cost estimates for Alternatives 11 and 13M that were submitted by email on September 4, 2009, in support of the Alternative 13M Evaluation Report (ERM and URS, 2009) that question Intalco's assumption on lime consumption used in their estimate for groundwater treatment system costs. The commenter provided clarification of Intalco's cost estimate assumptions.

Response:
Thank you for the clarification. The comment does not provide any new information that affects remedy selection.

Unique comment(s) addressed:
URSC09-09

Comment and Response: 72-1

Comment:
How long are the groundwater treatment plants expected to last before building another one?

Response:
The proposed groundwater treatment facility consists of a number of discrete components that have different service life expectancy depending on the type of equipment and maintenance requirements, e.g., pumps with motor starters and controls (10 years), reagent bins (50 years), and mixers (20 years). Life expectancy of the equipment was estimated from manufacturers' information for cost estimating purposes as part of the final Feasibility Study, and will be refined during Remedial Design. Remedial operations are expected to be needed for more than 200 years, and the treatment system will need to be maintained (and worn out components replaced) as needed over this time.

Unique comment(s) addressed:
RGID01-01

Comment and Response: 72-2

Comment:
One comment provided a response to the Agencies' prior comments (Forest Service 2010b) on the Alternative 13M Evaluation Report (ERM and URS, 2009) that noted Intalco had not provided a justification for using unlined treatment system ponds. The commenter referred to Appendix H of the Alternative 13M evaluation report and noted that Intalco had retained a new consultant, MWH, to assess the effectiveness of treatment in unlined ponds during design based on results of a pilot treatment study.

Response:
Thank you for the clarification. The comment does not provide any new information that affects remedy selection.

Unique comment(s) addressed:
URSC07-33

Comment and Response: 76-1

Comment:
One comment provided a lengthy discussion summarizing historical interactions between Intalco and the Agencies in the context of a chronology of investigations and cleanup alternative evaluations. The comments presented the individual's perspective on how historical progress was repeatedly delayed by the Agencies.

Response:
The Agencies do not agree with many of the assertions in this comment or the general tone that implies that the Agencies have not worked with Intalco to identify and resolve the many complex issues affecting the RI/FS and selection of a final remedy for the Site.

It is not productive or helpful to discuss past schedule delays. Since these comments do not directly address the outcome of the remedy selection process or the merits of one alternative compared with another, the Agencies do not respond to the comment.

The Agencies feel that the current working relationship with Intalco and its current contractor is good and, as a result, are encouraged by the progress made in the past few years toward Site cleanup.

Unique comment(s) addressed:
TGAR03-01

L:\Jobs\476916\Response to Comments\Responsiveness Summary January 2012.doc