Holden Mine Cleanup Project

Update

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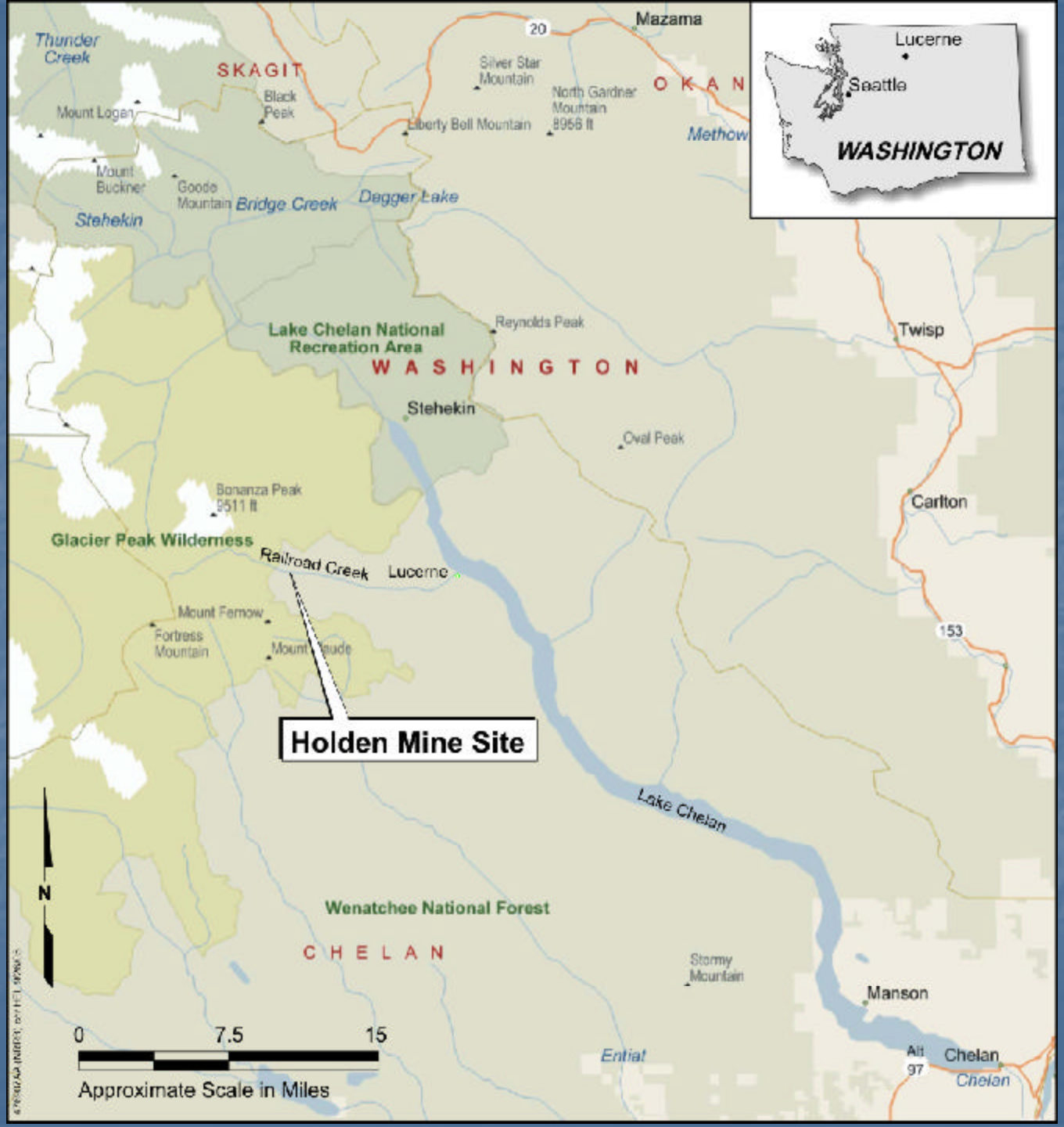
Project Manager

Okanogan – Wenatchee National Forest

Overview of Presentation

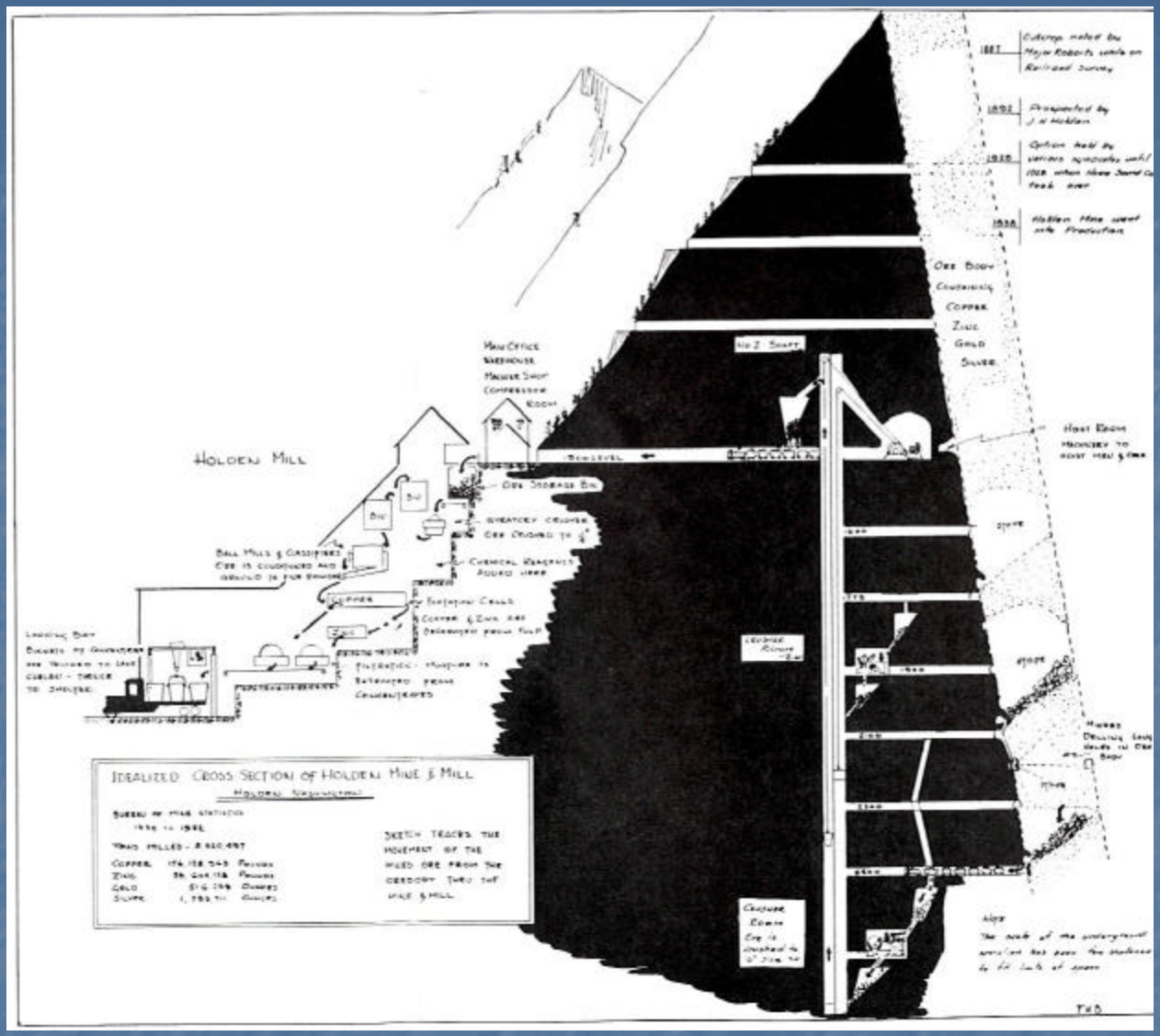
- Background & Project Chronology
  - Mine history
  - Forest Service's Interim Action (1989 – 1991)
  - Agencies' Current Cleanup Effort (Why it has taken so long)
- Site Characterization & Risks
- Agencies' Objectives for Site and Issues Driving Remedy Selection
- Alternatives Being Considered in Final Evaluations
  - Alternatives 11M, 13M, and 14
- Alternative 14 and Potential Contingent Actions
- Next Steps/Schedule


Mazama
20
Thunder Creek
SKAGIT
Silver Star Mountain
North Gardner Mountain 8958 ft
OKAN
Methow
Mount Logan
Black Peak
Liberty Bell Mountain
Mount Buckner
Goode Mountain
Bridge Creek
Dagger Lake
Stehekin
Lake Chelan National Recreation Area
Reynolds Peak
WASHINGTON
Twisp
Stehekin
Oval Peak
Carlton
Bonanza Peak 8511 ft
Glacier Peak Wilderness
Railroad Creek
Lucerne
Mount Fernow
Fortress Mountain
153
Holden Mine Site
Lake Chelan
N
Wenatchee National Forest
CHELAN
Stormy Mountain
Manson
0
7.5
15
Approximate Scale in Miles
Entiat
Alt 97
Chelan
Chelan
Lucerne
Seattle
WASHINGTON

Holden Mine History

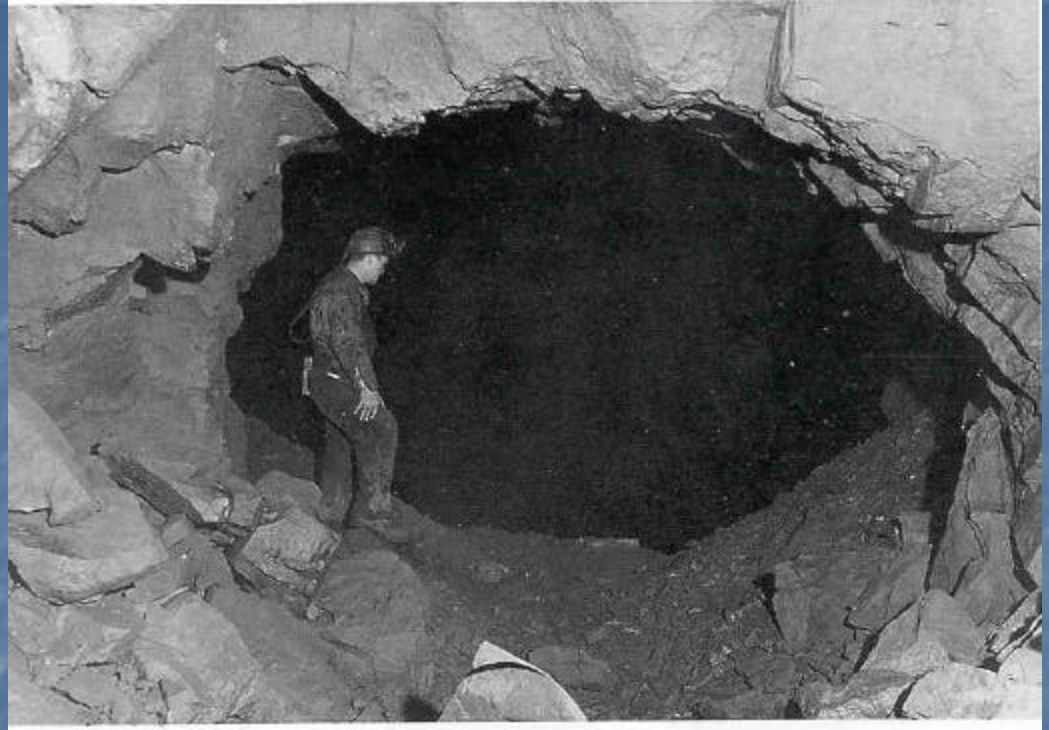
- The Howe Sound Mining Company operated the Holden Mine from 1937 to 1957.

Larry Penberthy Photos



- During operation, about 57 miles of underground mine workings were developed and 10 million tons of ore was mined and milled.

Larry Penberthy Photos



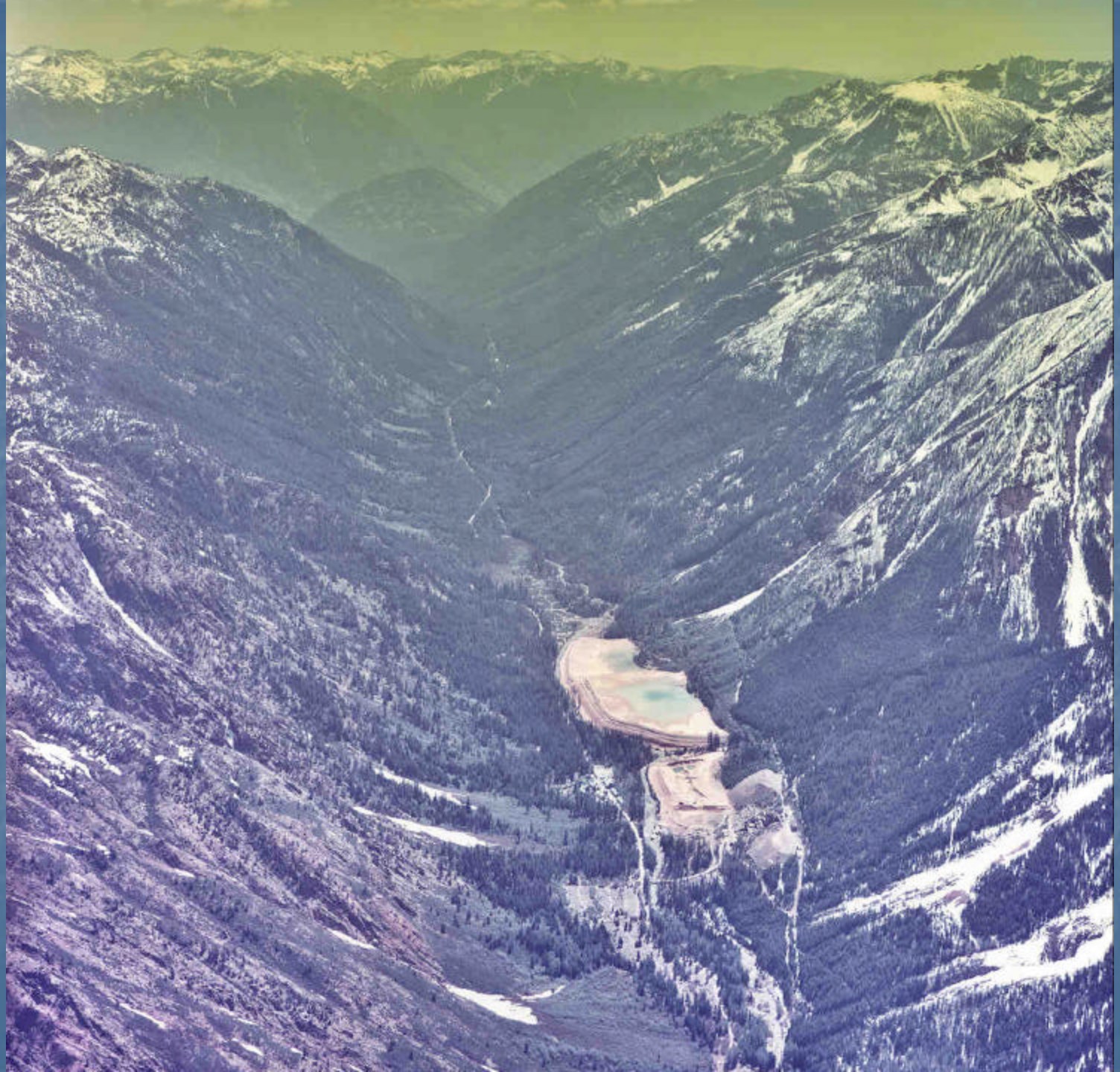
Miner for scale

- The mine and mill produced some $66 million from copper, zinc, silver and gold ---- today it would be ~ $800 million.

Holden Village – Former Company Housing for the Mine

- A few years after the mine shut down, mining property interests (patented and unpatented mining claims, buildings & facilities) were deeded to Lutheran Bible Institute.

- Holden Village incorporated in 1962 and has since used the mining village as a nondenominational retreat center under an Organizational Camp Special Use Permit with the Forest Service.



1989-1991 Forest Service Interim Action

- The interim action reduced erosion of the tailings piles by installing stream bank protection,

1989-1991 Forest Service Interim Action

- rerouting drainage off the tailings piles,

1989-1991 Forest Service Interim Action

- and covering the tailings piles with gravel, which reduced dust generation, and also facilitated revegetation of the tailings piles.

Post Interim Action

- However, several significant threats to the environment still existed, thereby, necessitating further action. They include:
  - Leaching or movement of contaminants from the mine portal, waste rock piles, tailings piles and elsewhere that degrade water quality and fisheries in Railroad Creek.

Post Interim Action

- Cementation or solidification of the creek bed in Railroad Creek, reducing aquatic habitat; and

Post Interim Action

- Potential for sudden or long-term erosion of tailings into Railroad Creek

Project Chronology – Current Efforts

- 1995/96 – PRP identified and current cleanup efforts begin
- AOC (1998) between USFS, EPA, WA-DOE with PRP directing the PRP to perform a RI/FS
- Close Coordination with the Yakama Nation
- PRP: Howe Sound – Alumet – Intalco (Rio Tinto acquired Alcan in late 2007 & now guiding RI/FS)

Project Chronology – Current Efforts

- Joint CERCLA & MTCA Authority
- Site not listed on NPL
- Mixed ownership site (private & federal lands)
- Largest CERCLA project in Pacific Northwest Region of Forest Service
- Concurrent NRDA
- Forest Service is lead agency directing the RI/FS and lead Trustee for NRDA

Project Chronology – Current Efforts

- Spring 1997 – Intalco and their consultants began collecting environmental data to characterize contamination at the site and to assess injury to the natural resources.
- The Final Remedial Investigation Report was approved by the Agencies on February 8, 2002.

Site Chronology - Additional Groundwater & Geotechnical Investigations 2002 & 2003

Project Chronology – Current Efforts

- The Draft Feasibility Study and Draft Final Feasibility Study were delivered to the Agencies for review on June 12, 2002 and February 19, 2004 respectively.
- At that time, there were 8 basic alternatives analyzed in the Feasibility Study. (7 action & 1 “no action” with multiple sub-alternatives)

Site Chronology - 2003 Fall Flood Damage

Site Chronology - 2003 & 2004 Flood Damage Repairs

Site Chronology – 2006 Spring Flood Damage Repair

Current Project Efforts

- In September 2007, the Agencies finalized a SFS which analyzed several new Alternatives (9, 10, 11 and 12 - True no action Alt) and identified Alternative 11 as the Agencies' preferred Alternative (Main feature: Site-wide GW containment via stream-side fully penetrating barrier wall)

- October 2007 – In response to Agencies Alt 11, Intalco submits Alt 13M (GW containment in western portion of Site via stream-side fully penetrating barrier wall, Realignment of Railroad Ck and dependence on results of remedy components & attenuation in eastern portion of site down gradient of TPs 2-3)

Current Project Efforts

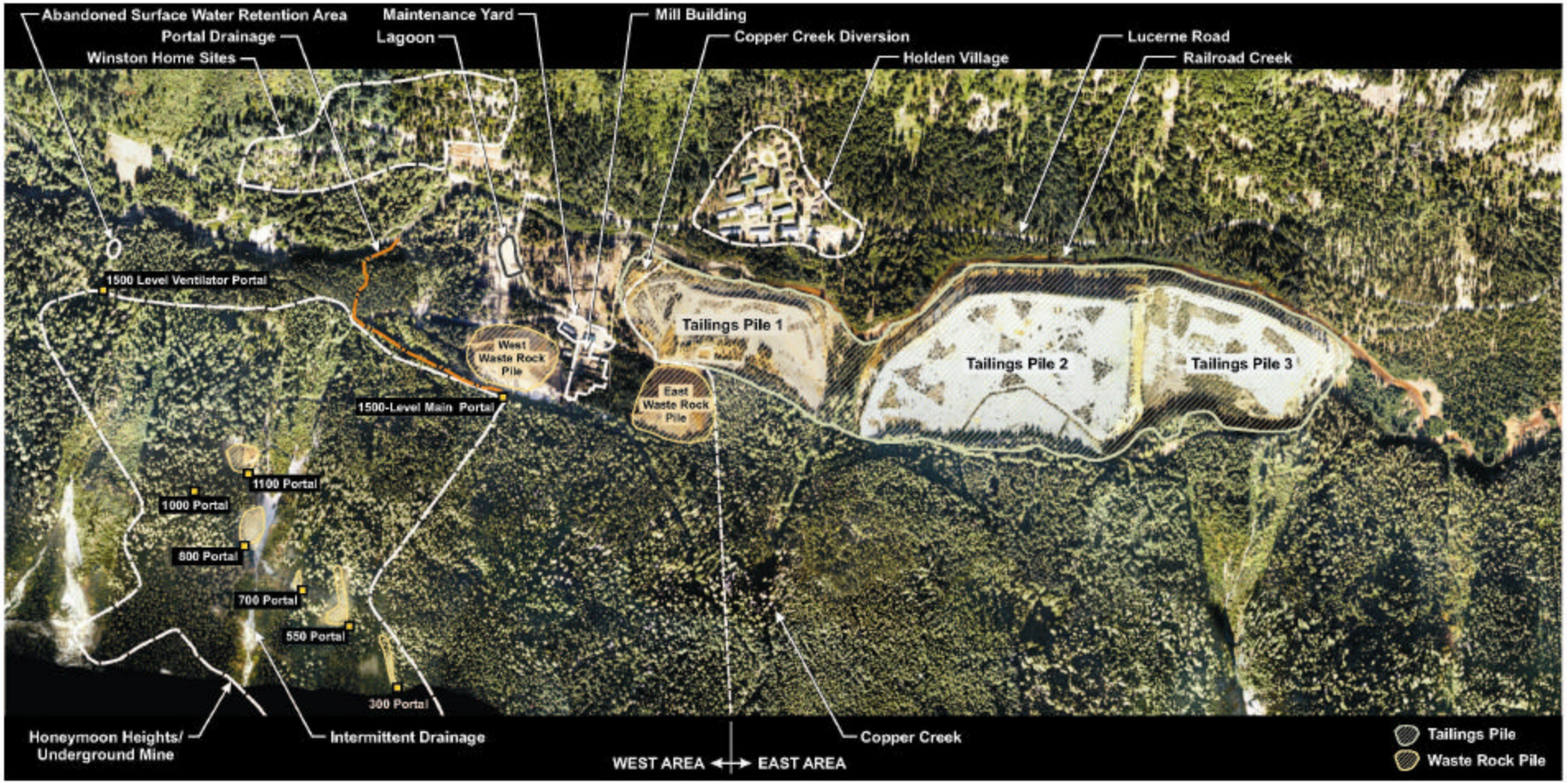
- March 2008 – Agencies agree to consider alternative remedy components proposed in Alt 13M, if demonstrated to be equally protective as Alt 11M components.
- 2008 & 2009 Field Seasons – Intalco conducts extensive site investigations to justify their Alt. 13M (No eastern barrier wall)

Agencies' Develop New Alternative (Alternative 14)

- Considering the Agencies' objectives for the Site, and results from Intalco's 2008 & 2009 field investigations, the Agencies developed a new Alternative (Alt 14) which is a hybrid of Alternatives 11M & 13M.

- Agencies are finalizing an Addendum to its 2007 SFS, that evaluates Alternatives 11M, 13M, and 14; which will identify its preferred Alternative.

Site Features

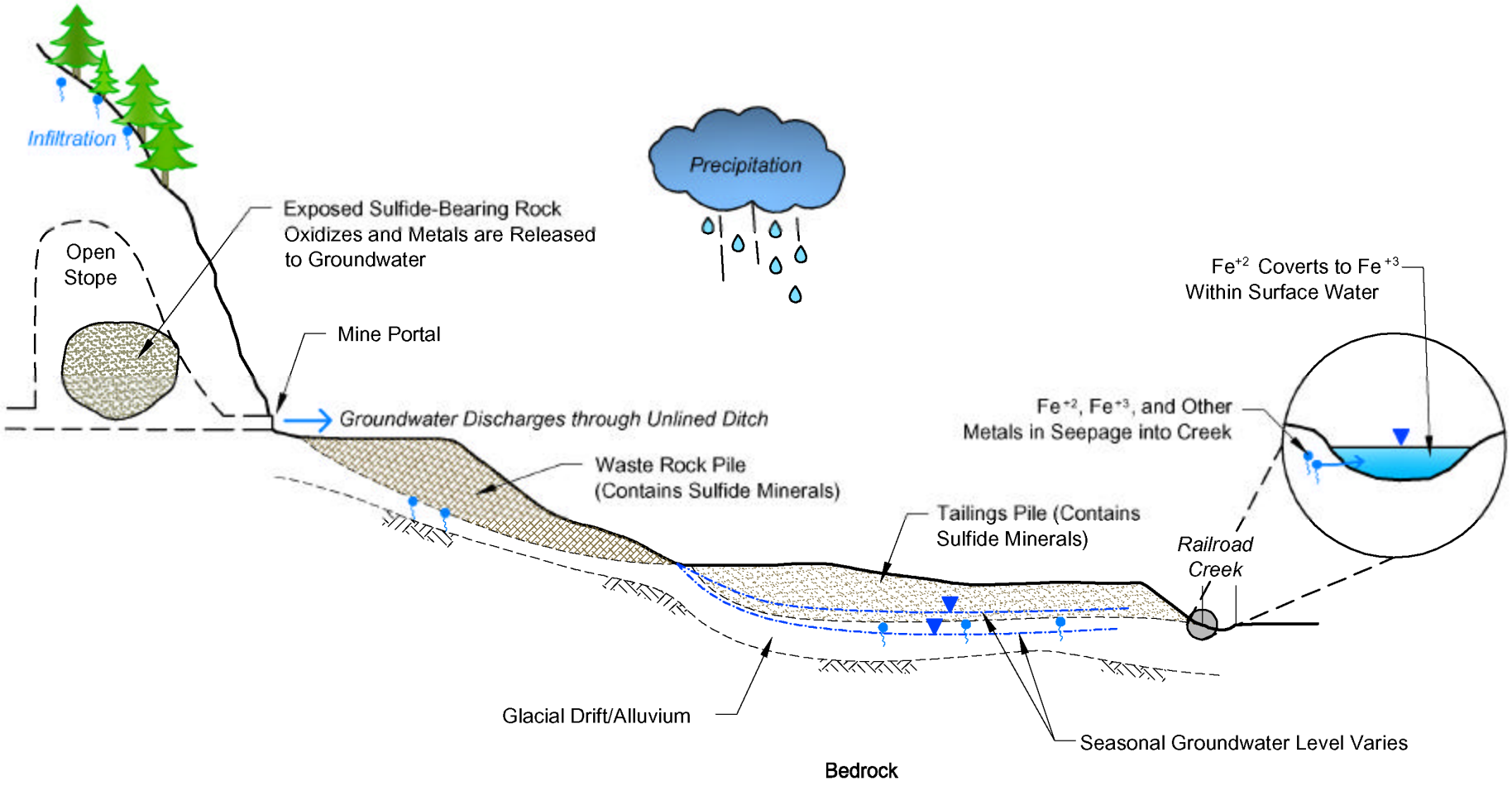


Summary of Site Characteristics & Risks

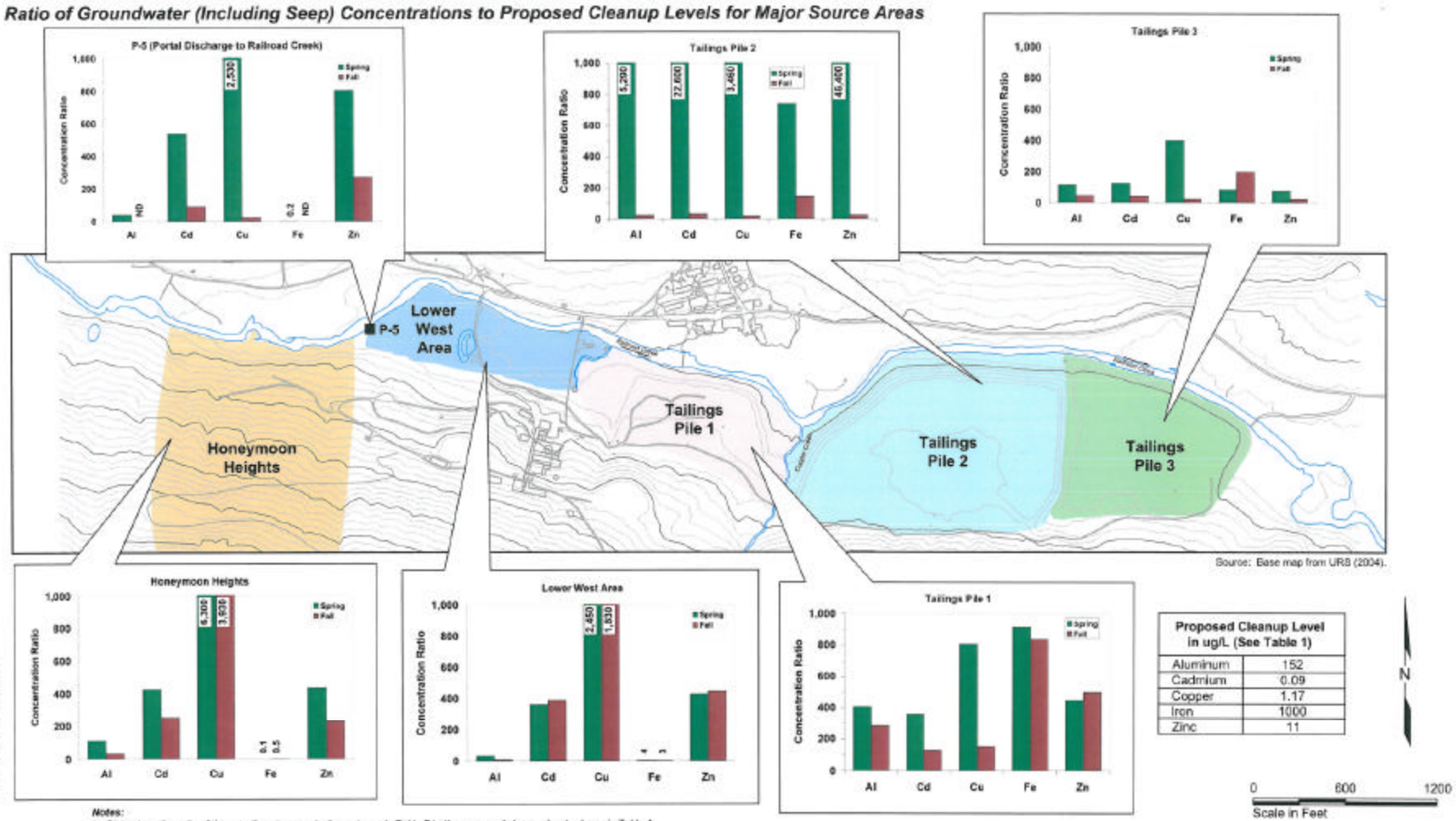
- Primary aquatic COC
  - Toxicity of 5 metals: Al, Cd, Cu, Fe, Zn
  - Physical impacts to aquatic habitat: Fe
- Concentrations for aquatic life protection are low
  - Low water hardness
  - Background concentrations for Al and Cd exceed WQC
- Terrestrial Ecological Risks in Soils
  - HQs range up to 1,000 for plants, 300 for macro-invertebrates, and potential risks for birds & mammals feeding in some AOIs w/high metals concentrations
- Human Health
  - Metals (As, Cd, Cu, Pb, Zn) exposed in soils and tailings exceed criteria for direct contact & ingestion
  - Metals (Al, As, Cd, Cu, Pb, Ni, Zn) in groundwater & portal discharge exceed criteria for drinking water by up to 31 times.
  - Petroleum hydrocarbons released to soils in limited areas

Conceptual Model

- Long-term release due to perpetual geochemical engine



Ratio of Groundwater Concentrations



Notes:

1. Plots show the ratio of the constituent concentrations shown in Table 7 to the proposed cleanup levels shown in Table 1. Concentration Ratio = Constituent Concentration/Proposed Cleanup Level.
2. Additional details on the determination of constituent concentrations are noted on Table 7.
3. Additional details on proposed cleanup levels are provided in the text and noted on Table 1.
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.

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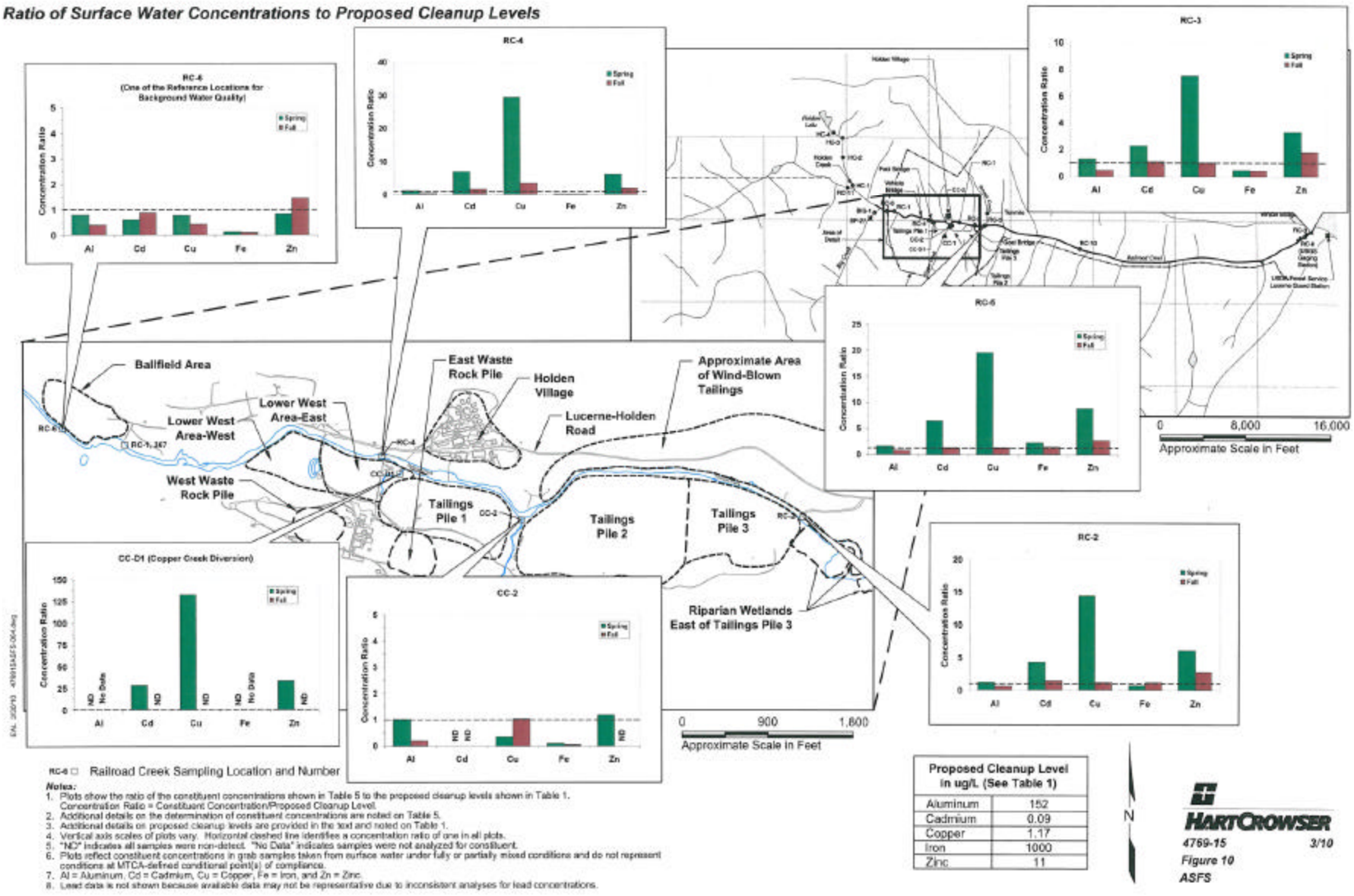
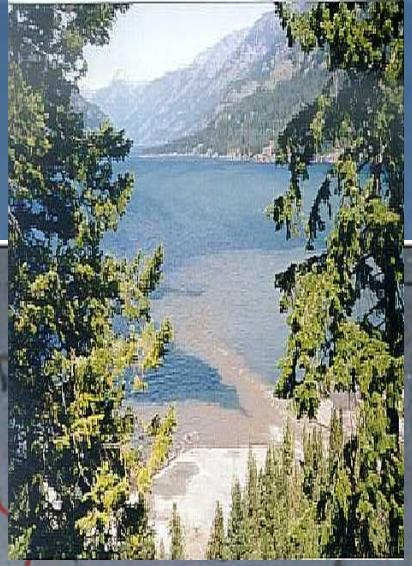
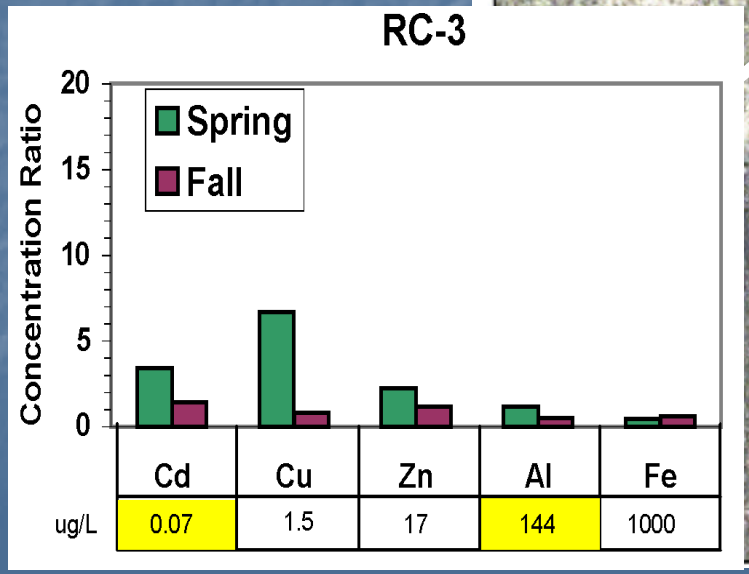
4769-15 3/10
Figure 6
ASFS

Ratio of Surface Water Concentrations



Surface Water Quality at RR Creek Discharge to Lake Chelan





Agencies' Objectives for Holden Mine Cleanup Action

- It should address all sources of contamination across the site, particularly discharges to Railroad Creek immediately after implementation
- It should satisfy CERCLA & MTCA threshold criteria
  - Protective of human health and the environment; and
  - Meet regulatory standards (ARARs)
- It should also satisfy the RAOs, which includes protection of Holden Village residential community during and after remedy construction; and
- It should be a FINAL Remedy for the Site under both CERCLA & MTCA

Issues Driving Remedy Selection

- Protection of aquatic life is the driver for site cleanup – institutional controls will address future human health risk.
- Surface water cleanup levels are based on NWQC (Cu and Fe), SWQC (Zn) and background (Al & Cd).
- Washington State has authority concurrent to CERCLA under it's Model Toxics Control Act (MTCA).
  - Groundwater containment shall be implemented to the maximum extent practicable
  - Alternate Point of Compliance allowed after AKART
- State also requires closure of the tailings and waste rock piles to conform to Limited Purpose Landfill requirements. (Presumptive remedy components unless studies show otherwise – TEE, geotech & seismic studies, etc.)
- Agencies prefer selection of a Final Remedy.

3 Alternatives in Final Evaluation

- Agencies Finalizing the Addendum to 2007 Supplemental Feasibility Study (ASFS)
  - Alternatives 11M, 13M, and 14
- 7 Criteria Used in Detailed Analysis

  (The first two are considered "Threshold" Criteria
  The remaining are considered "Balancing" Criteria)
  - *Overall protection of human health and the environment*
  - *Compliance with applicable or relevant and appropriate requirements (ARARs)*
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume through treatment
  - Short-term effectiveness
  - Implementability
  - Cost

Agencies' Alternative 11M

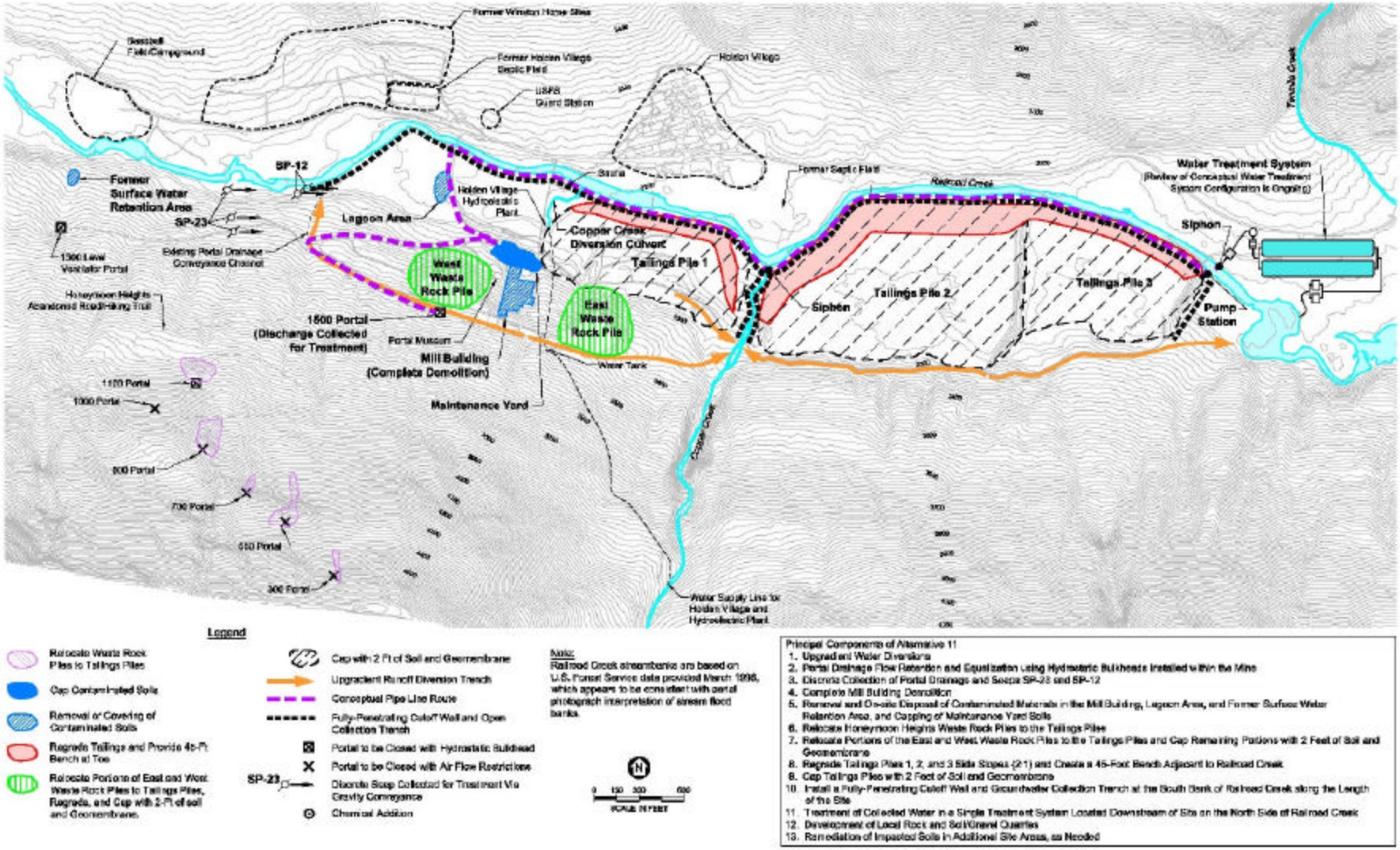


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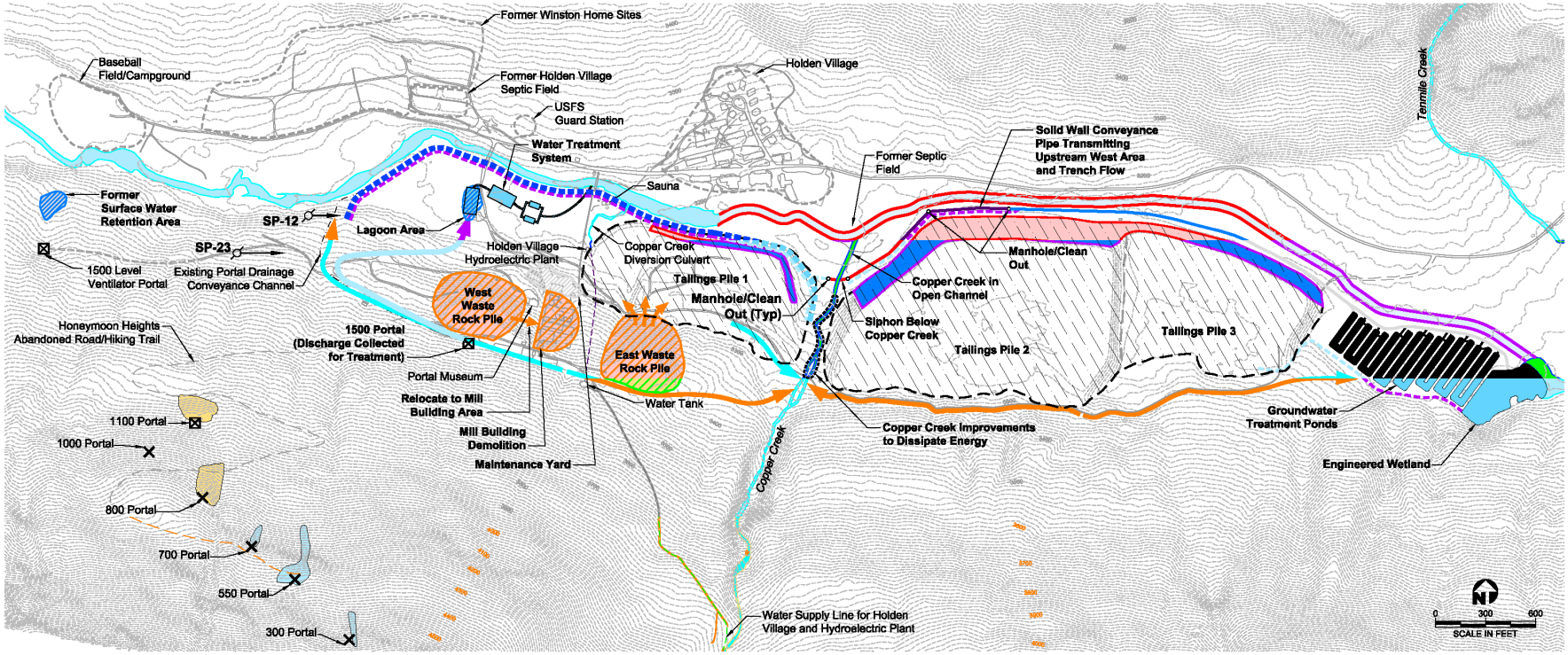
Figure 3
Principal Components of Alternative 11
Holden Mine RI/FS
Draft Summer 2008 Field Investigation
April 2008

Intalco's Alternative 13M



Legend

- Waste Rock Piles
- Regrade and Cover Waste Rock Piles with Soil
- Removal or Covering of Contaminated Soils
- Regrade Tailings Pile Slopes
- Cover with Soil on Top of Surface and on Slope
- 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

Note:
Railroad Creek streambanks are based on U.S. Forest Service data provided March 1998, which appears to be consistent with aerial photograph interpretation of stream flood banks.

Principal Components of Alternative 13M

1. Install mine access restrictions 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. 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 from Tailings Pile 1 at seep SP-1 to downstream of Tailings Pile 3
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

Q:\geo\Holden Mine\SubTasks\2008 Field Investigation\Meetings\Agency-GW Collection\Principal Components Alt 13M.dwg
Mod: 05/06/2009, 10:55 | Plotted: 05/06/2009, 11:20 | Layout: Alt 13M

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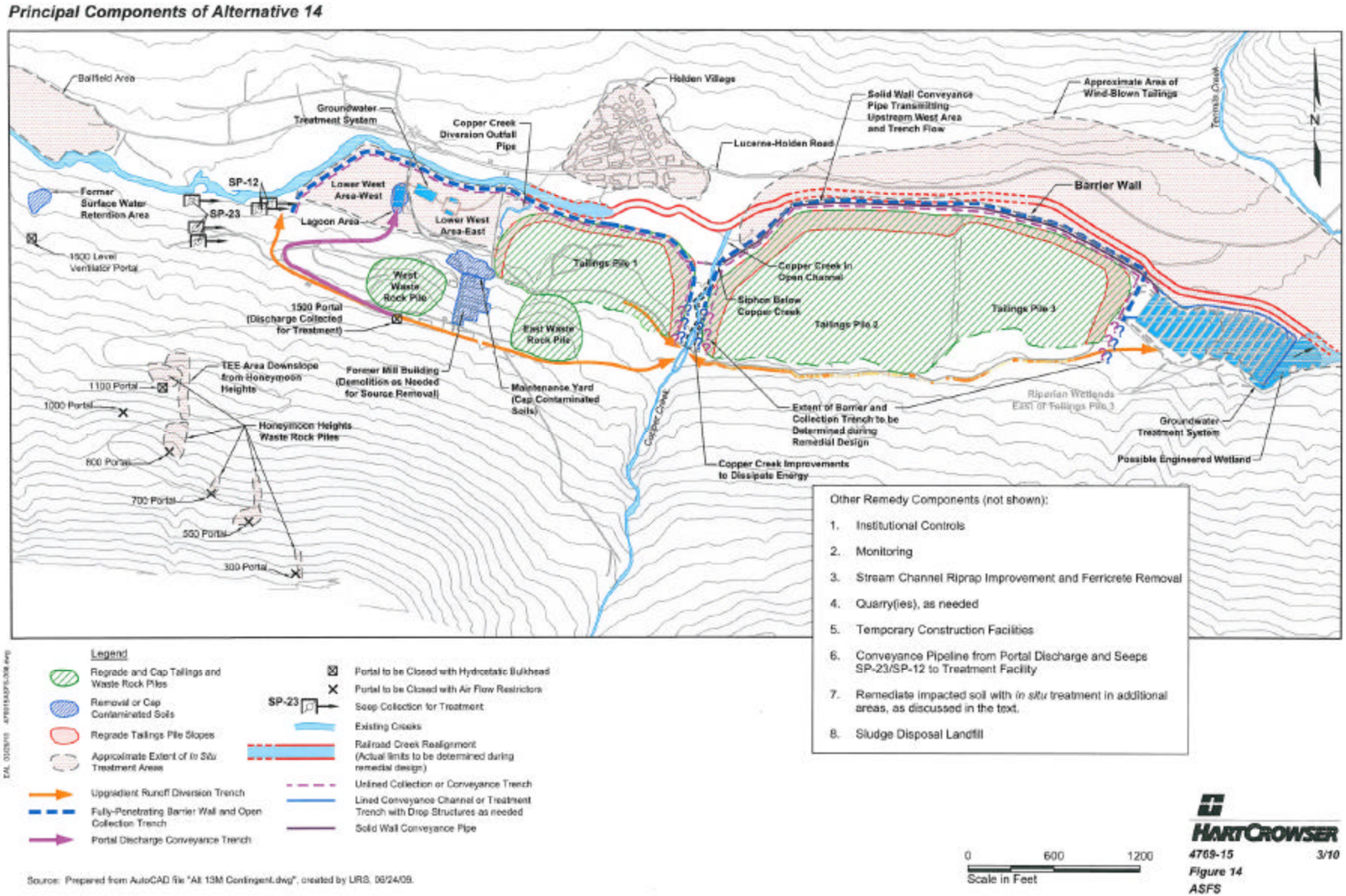
Principal Components of Alternative 13M

Holden Mine Alternative Remedy Components Evaluation
(PRELIMINARY - FOR DISCUSSION PURPOSES ONLY)

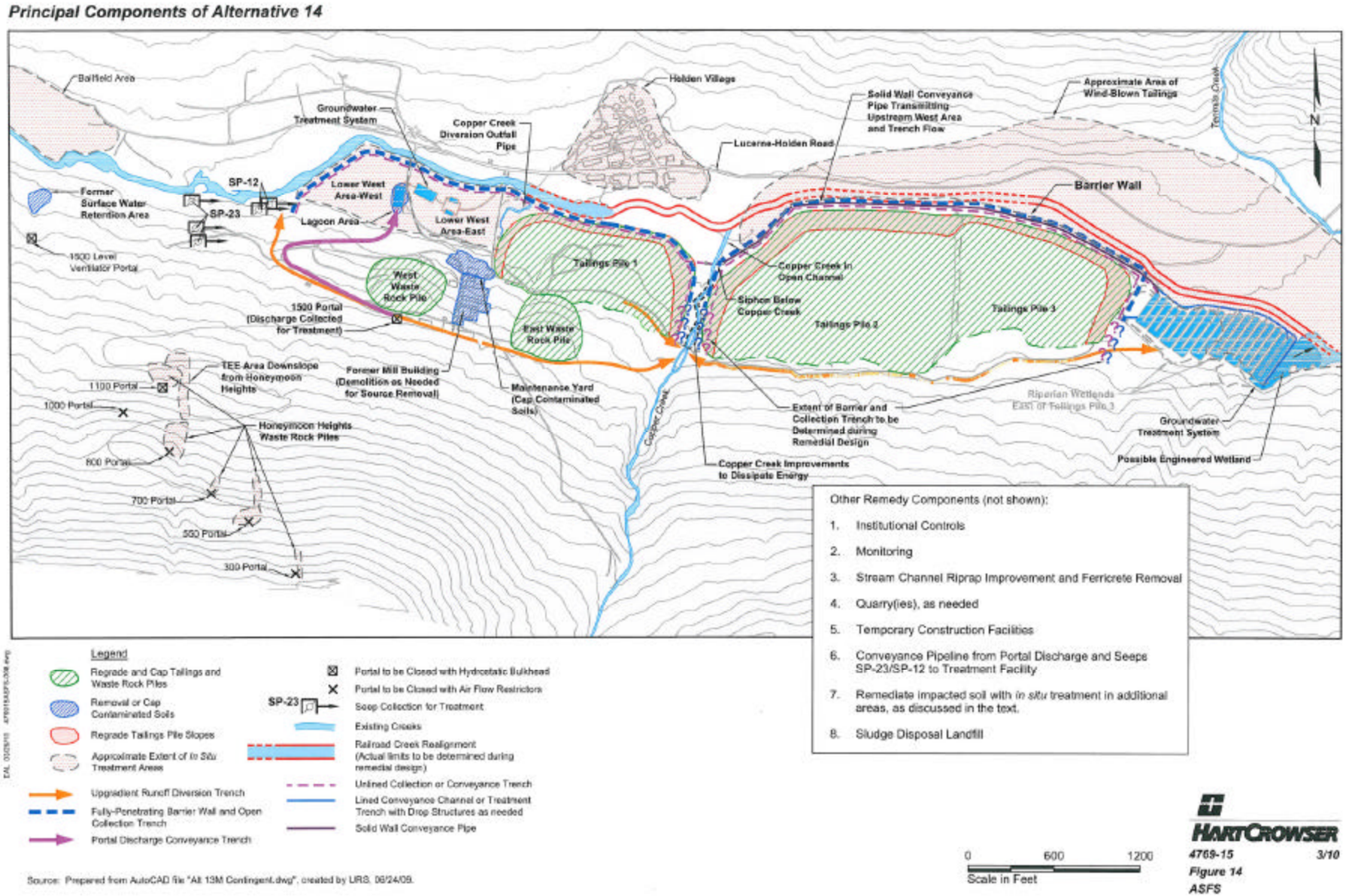
Agencies' Alternative 14



Costs for ASFS Alternatives
(in 2010 dollars)

	Alternative 11M	Alternative 13M	Alternative 14
Estimated Capital Cost	$88,600,000	$56,400,000	$74,600,000
Net Present Value of Long-Term Operations, Maintenance and Monitoring	$31,900,000	$23,400,000	$30,700,000
Total Estimated Cost	$120,500,000	$79,800,000	$105,300,000

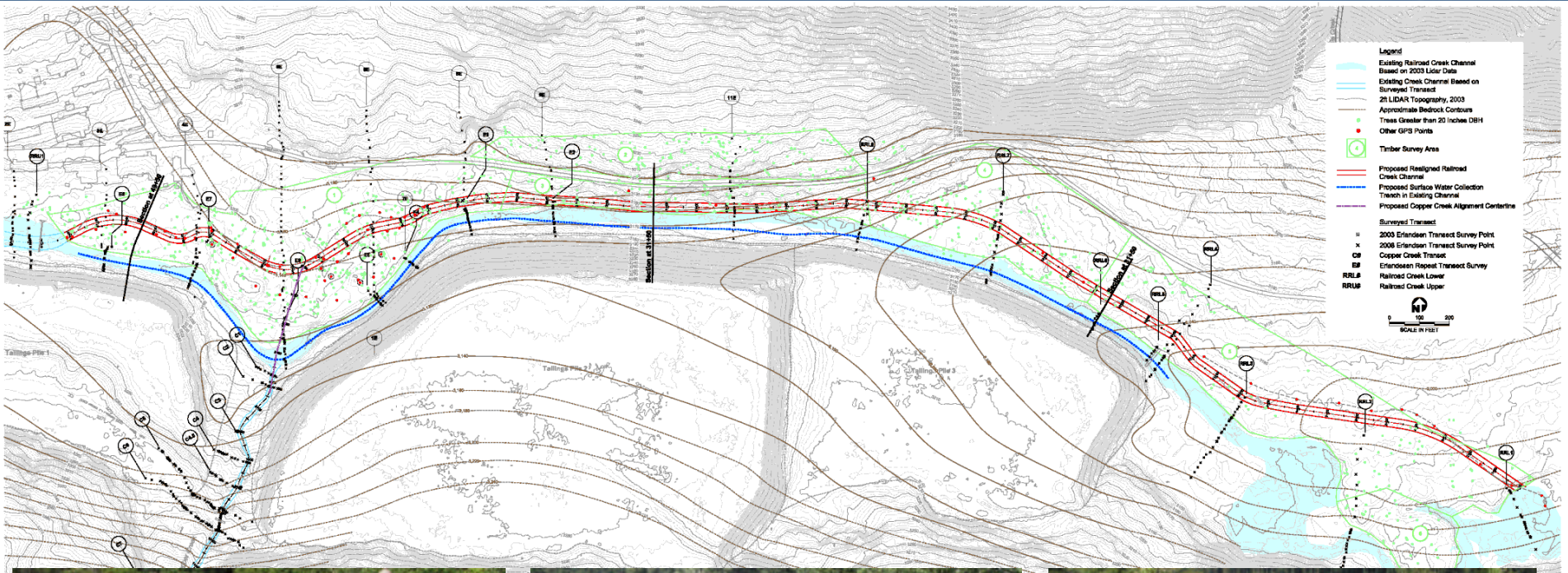
Agencies' Alternative 14



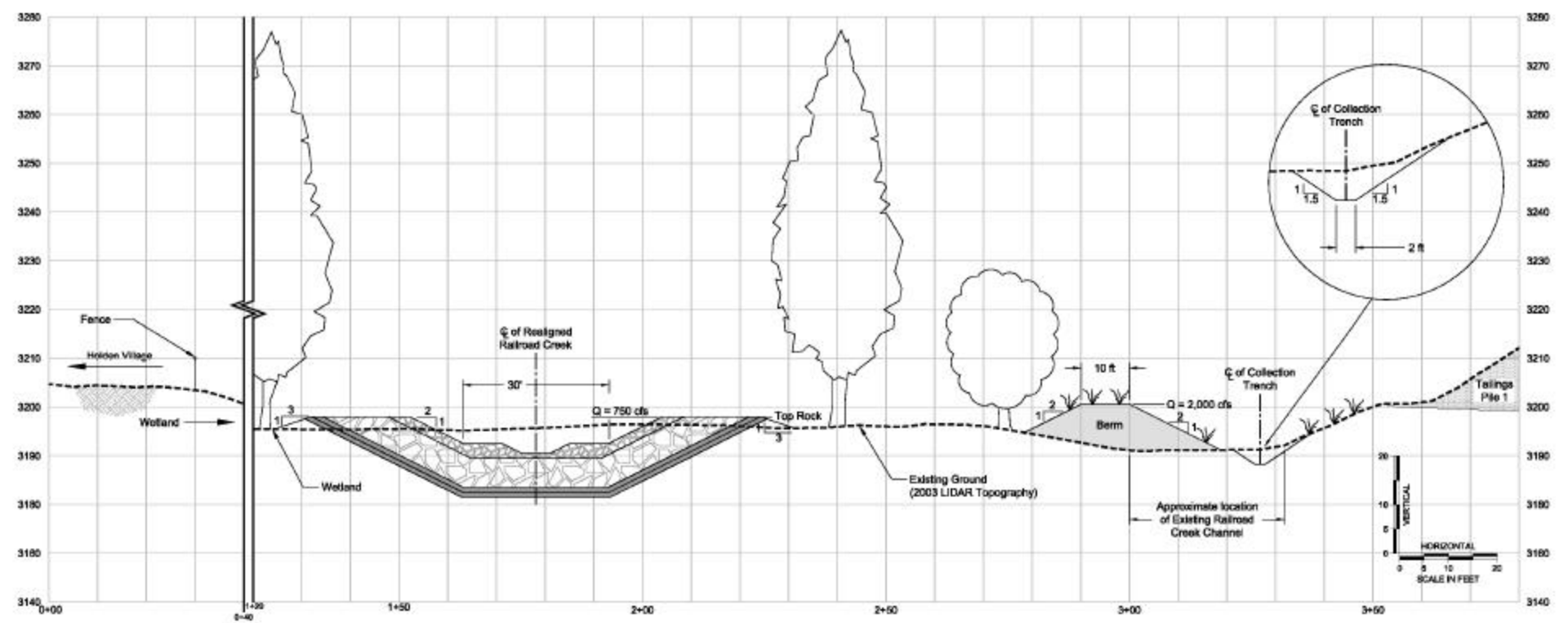
Water Treatment Plant(s)/System

- Conventional low energy process involving acid neutralization (lime addition) and precipitation treatment system TBD on results of treatability studies (2009 & 2010)
- One or two treatment plants & location TBD
- In-mine bulkheads (equalization of flow for treatment)

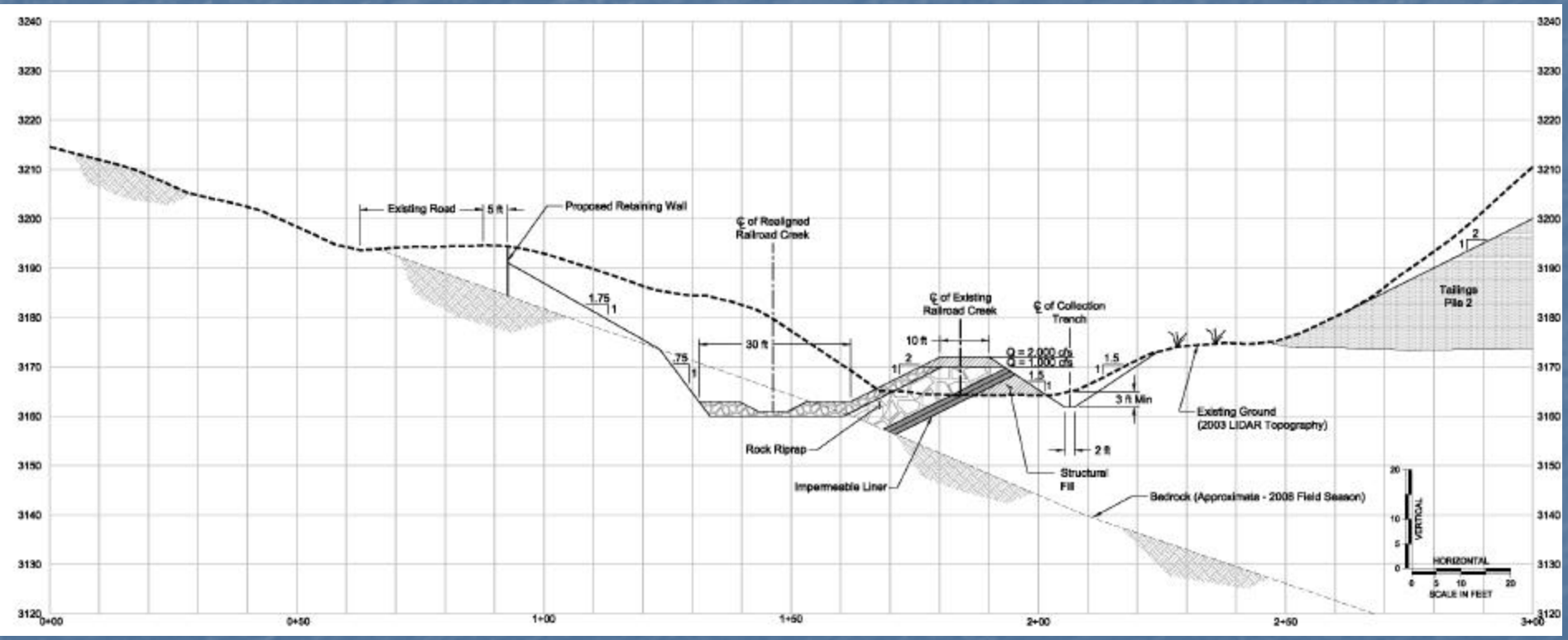
Proposed Railroad Creek Alignment



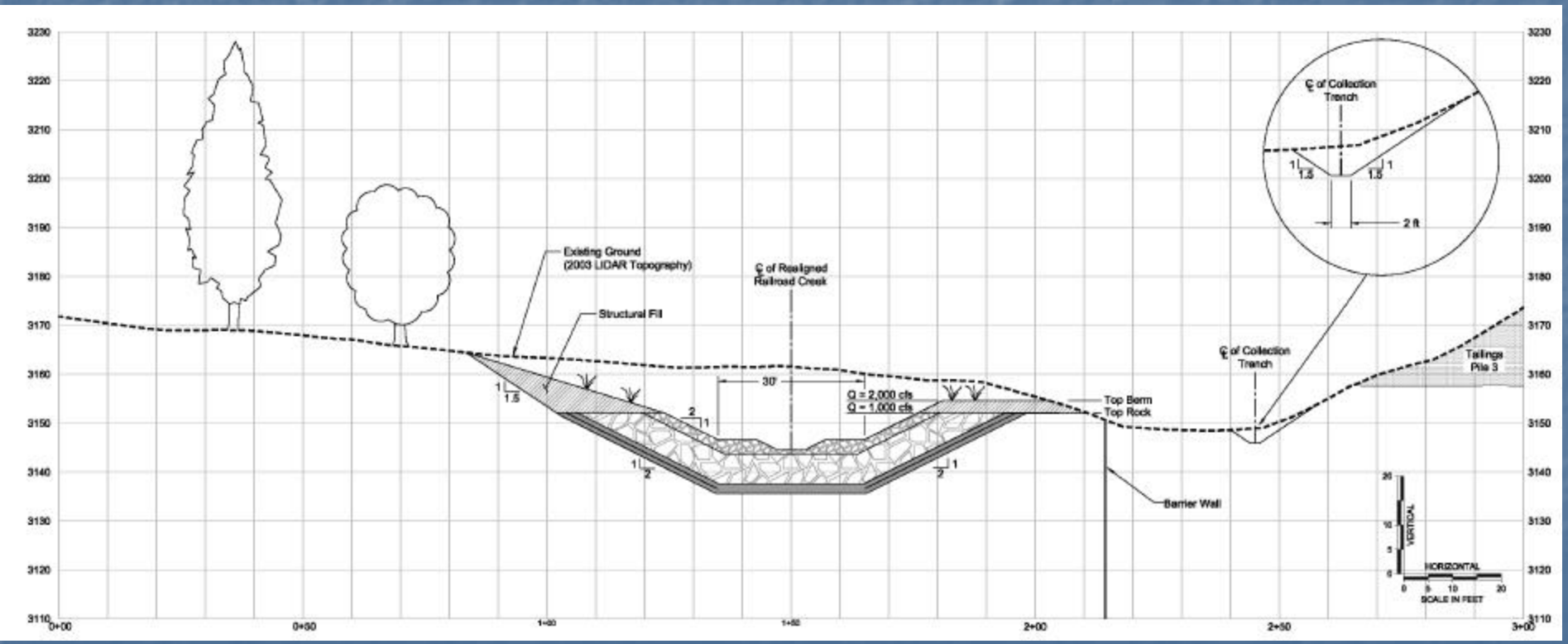
Holden Village Section



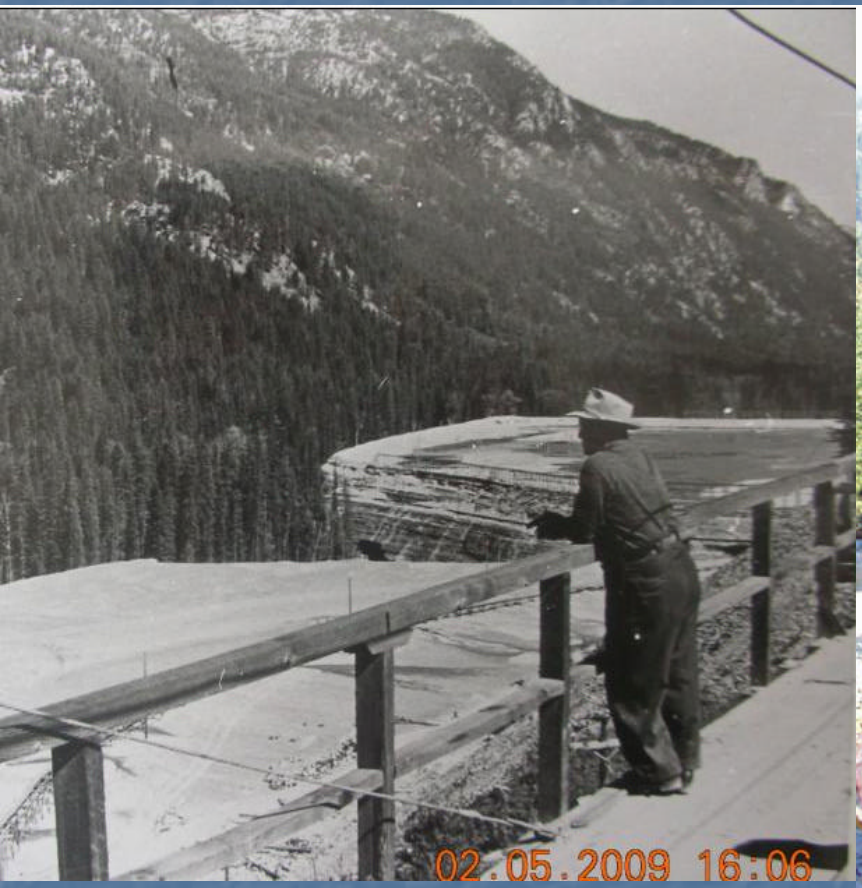
Tight Reach Cross Section



Two Stage Channel Cross Section



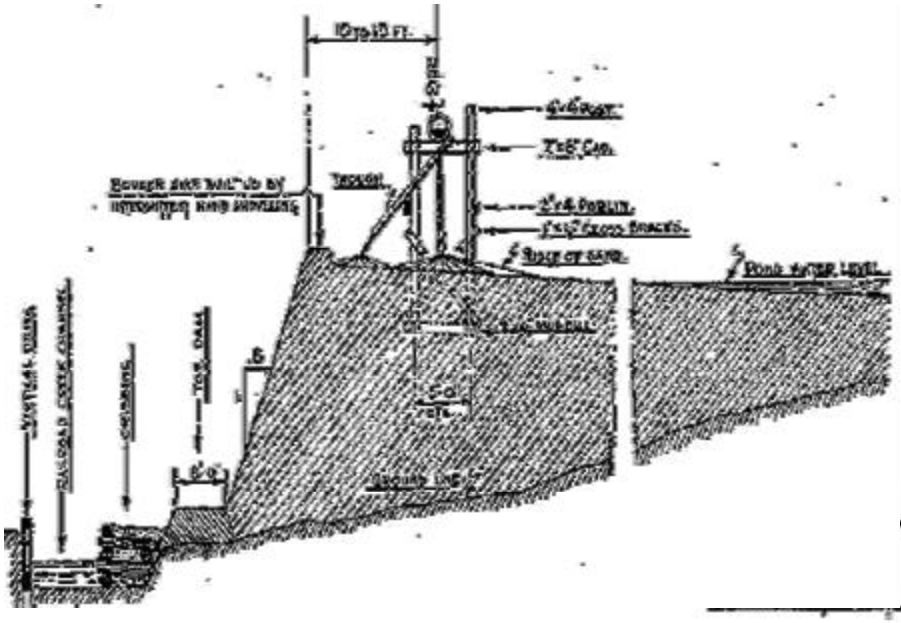
Tailings Piles Surfaces & Slopes



1940s **2008**

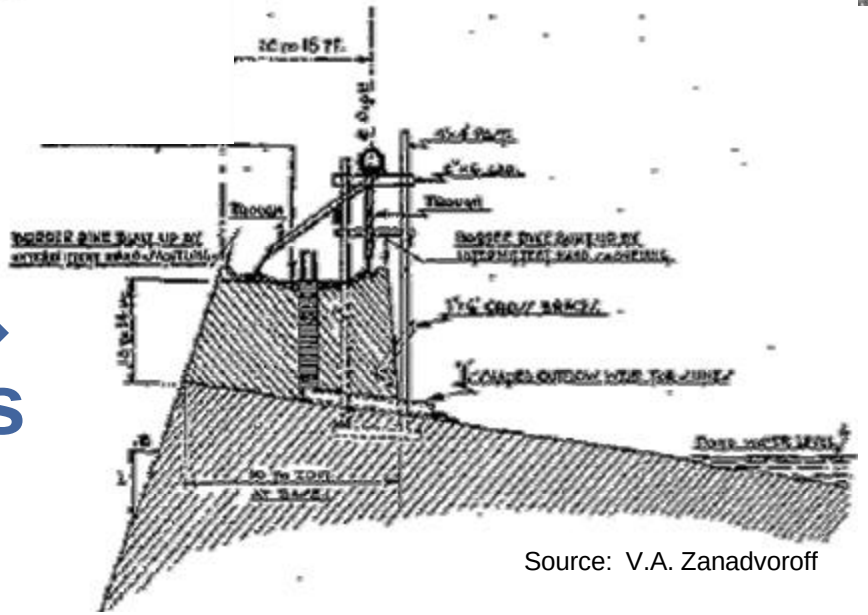
1940s 2007

Tailings Pile 1 Construction – 1938



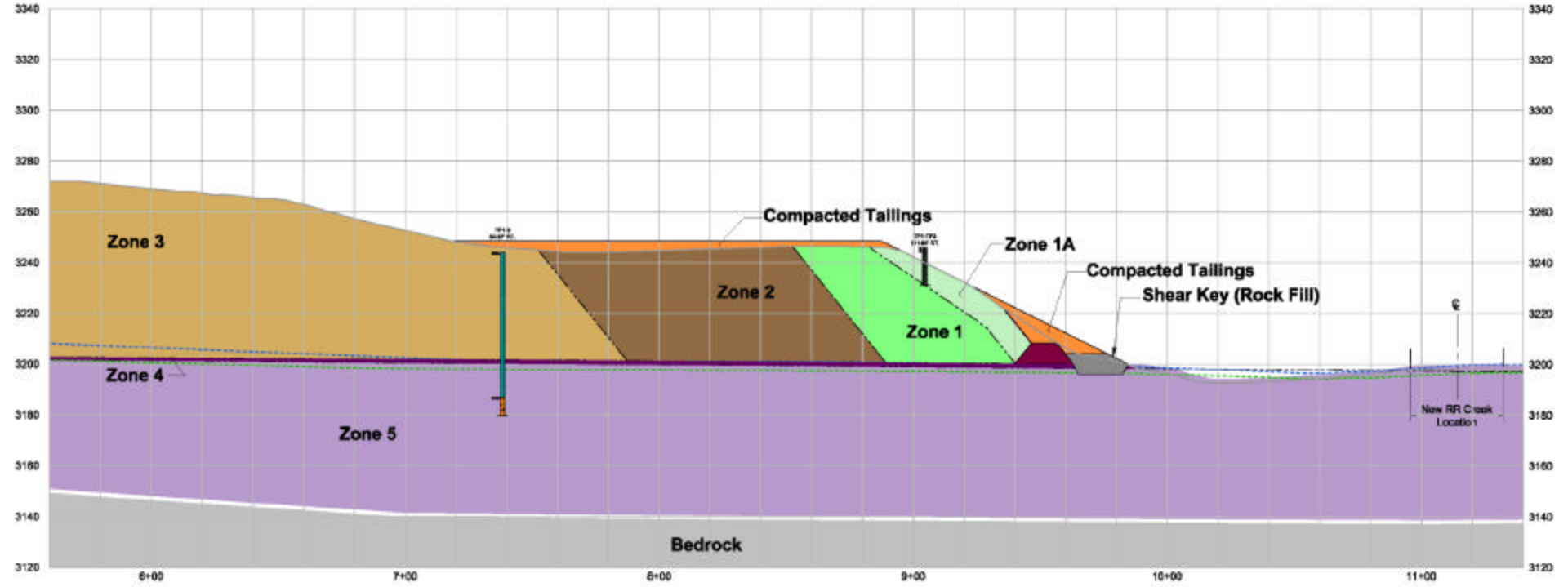
Source: V.A. Zanadvoroff

Tailings Pile ↑→ Diking Sketches 1946

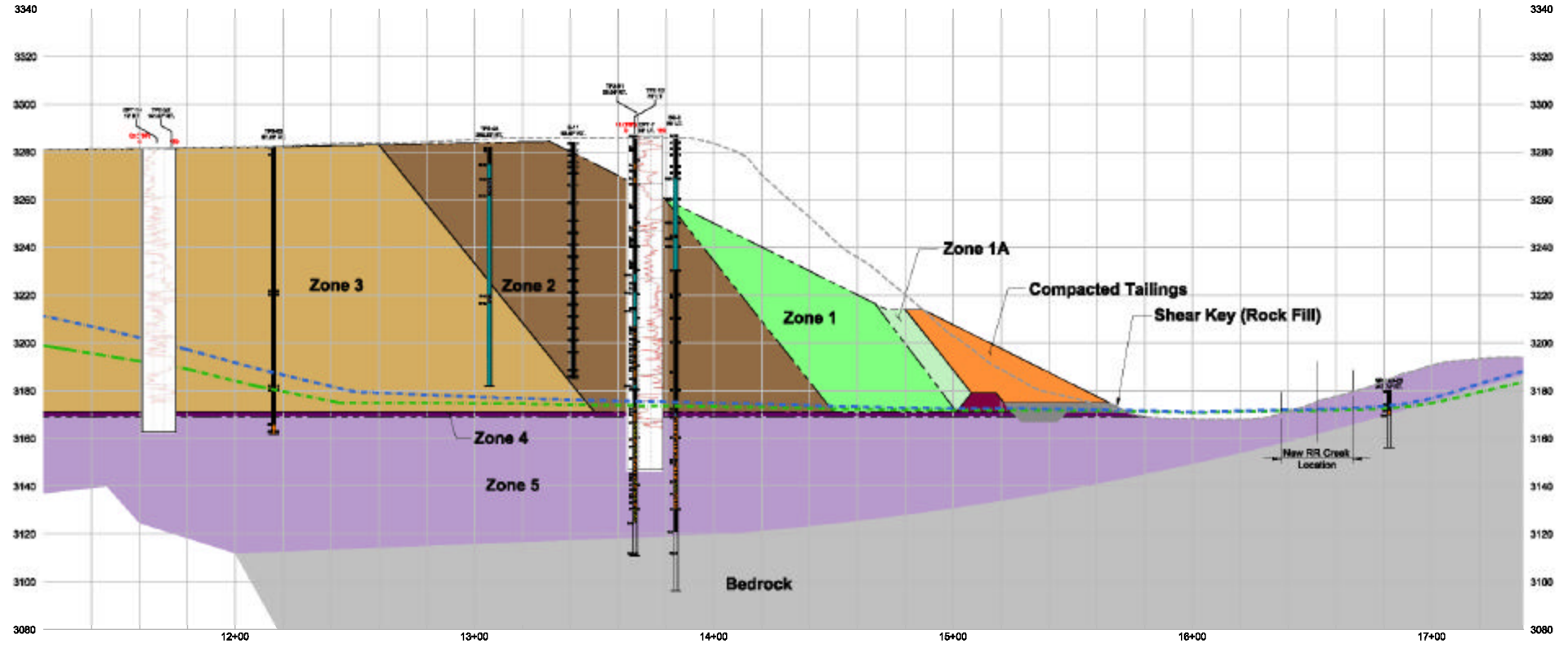


Source: V.A. Zanadvoroff

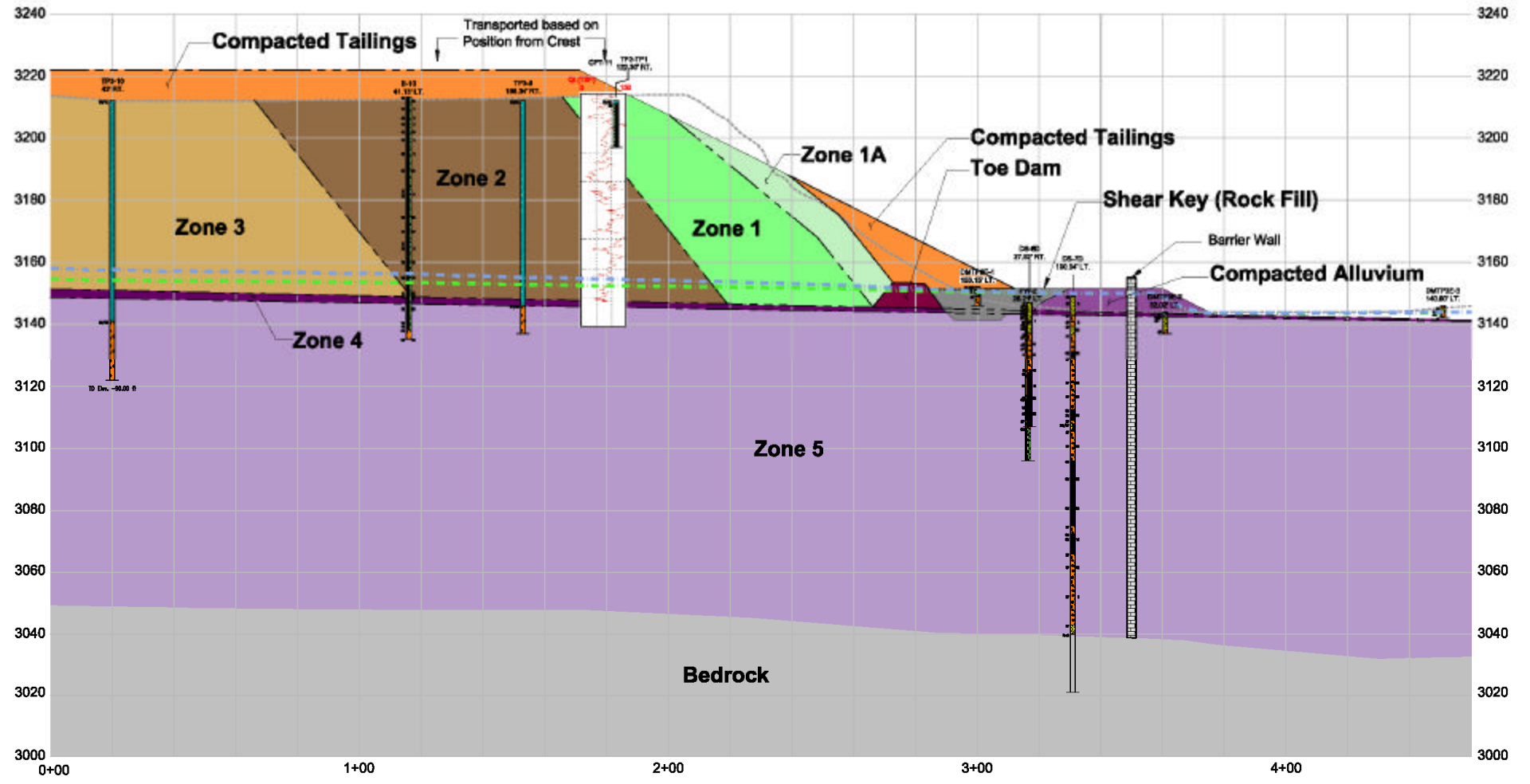
Tailings Pile 1 - B-B’



Tailings Pile 2 Section C-C’



Tailings Pile 3 - G-G’



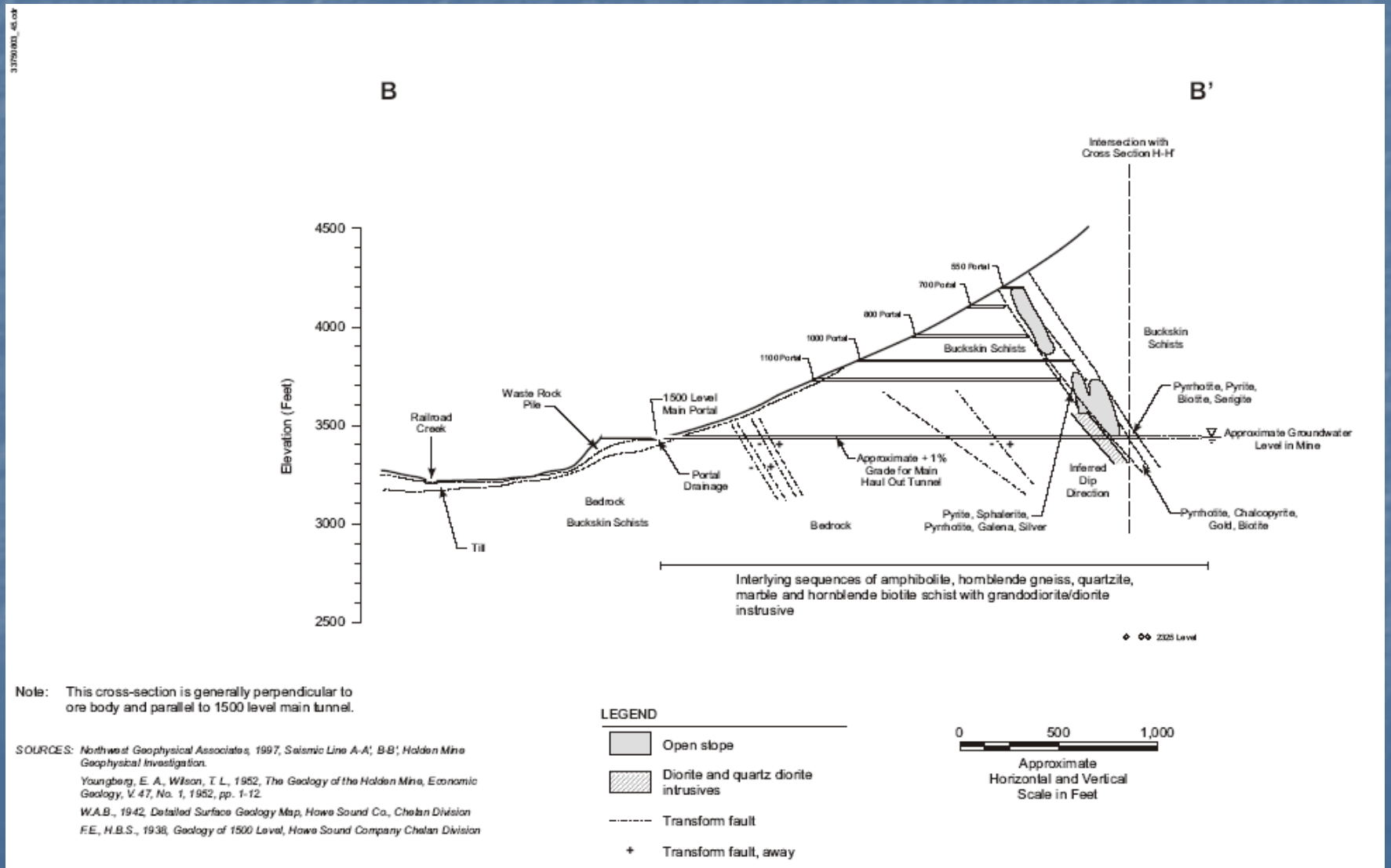
Former Mill Building

East and West Waste Rock Piles

Lower West Area

Honeymoon Heights Area

Cross-Section of Underground Mine Workings



Note: This cross-section is generally perpendicular to ore body and parallel to 1500 level main tunnel.

SOURCES: *Northwest Geophysical Associates, 1997, Seismic Line A-A', B-B', Holden Mine Geophysical Investigation.*

Youngberg, E. A., Wilson, T. L., 1952, The Geology of the Holden Mine, Economic Geology, V. 47, No. 1, 1952, pp. 1-12.

W.A.B., 1942, Detailed Surface Geology Map, Howe Sound Co., Chelan Division

F.E., H.B.S., 1938, Geology of 1500 Level, Howe Sound Company Chelan Division

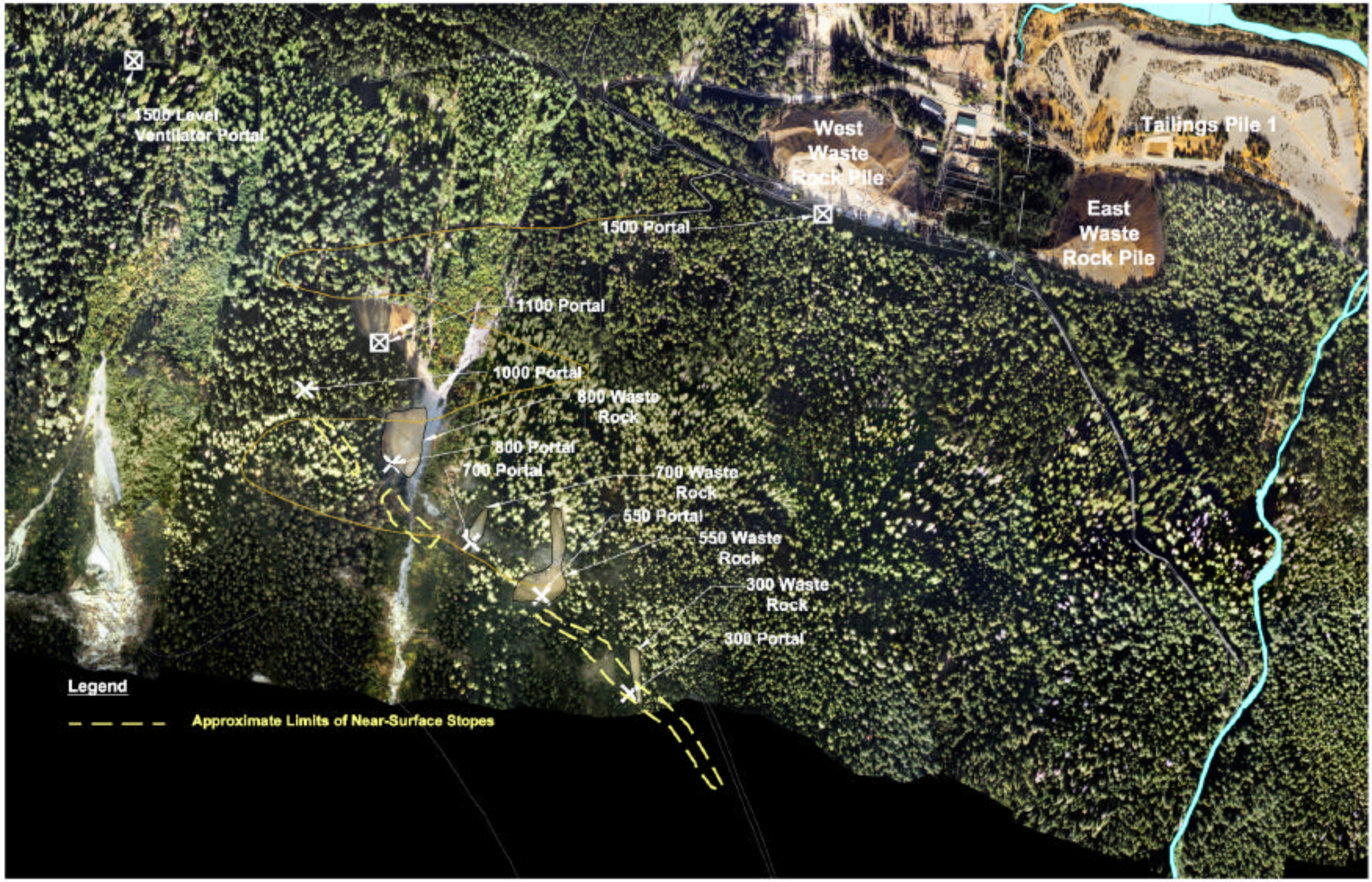
LEGEND

- Open slope
- Diorite and quartz diorite intrusives
- Transform fault
- \+ Transform fault, away

0 500 1,000

Approximate Horizontal and Vertical Scale in Feet

Honeymoon Heights Near-Surface Stopes



Maintenance Yard

Area of Windblown Tailings

Other Remedial Components

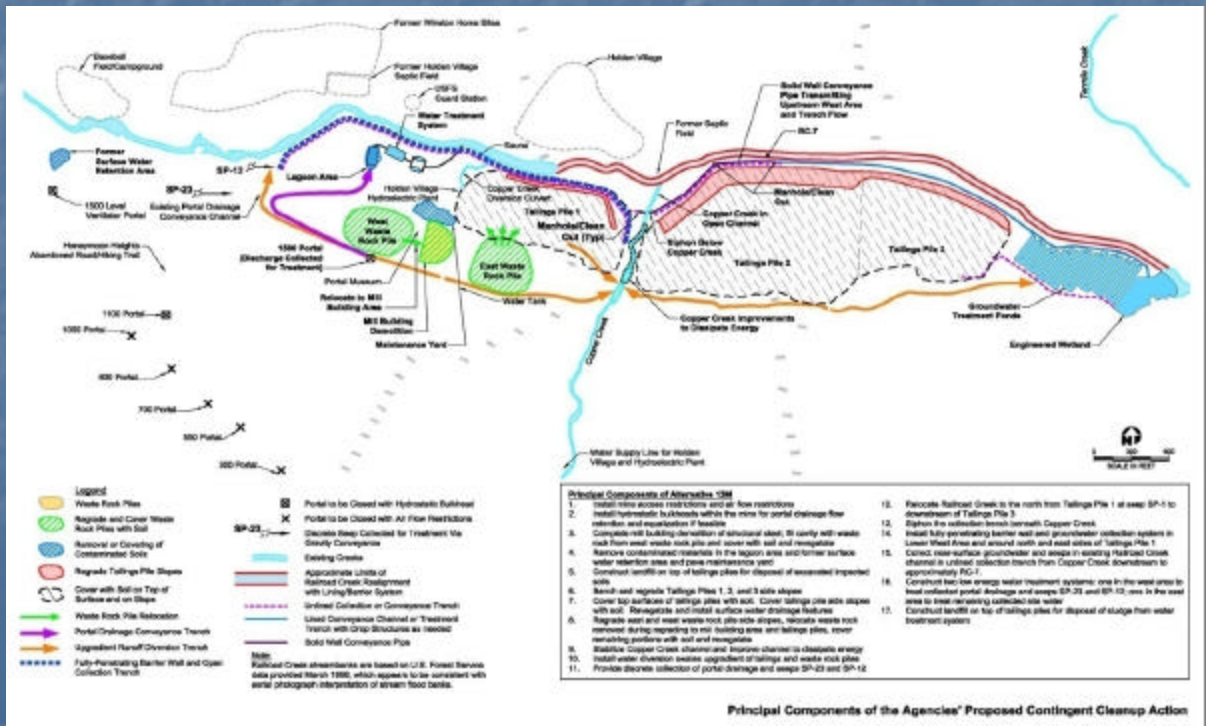
- Construction of Limited Purpose Landfill(s) –
  - For disposal of sludge & contaminated soils
- Development of Remedy Infrastructure –
  - Quarry site(s), borrow pits, upgrade of Lucerne barge landing & dock facilities on Lake Chelan, access road improvement, and electrical power (potential for hydroelectric)
- Institutional Controls –
  - Prevent changes that would reduce remedy effectiveness
- Long Term Monitoring –

Advantages of Agencies' Alternative 14

- It will address all sources of contamination across the Site, particularly discharges to Railroad Creek, immediately after implementation.
- Expected to satisfy the threshold criteria.
- Allows for consideration of Contingent Components proposed by Intalco in eastern portion of Site down gradient of TP-3.
- Is considered a Final Remedy, but construction may be phased.
- Net present value of Capital and OM&M Costs (2010 dollars) is currently estimated at $105.3 Million (up to an estimated $7 - 10 Million less if contingent action is implemented).

Potential Contingent Components

- To be determined following 1st phase of remedy construction and based on extensive monitoring, before (2 yrs), during (2 yrs), and after initial remedy construction (2 – 3 yrs).
  - Eliminate eastern barrier wall
  - Partially penetrating eastern barrier wall
  - Well Field – Selective pump and & treat
  - Passive/Reactive barrier
  - Etc.....



Next Steps and Schedule for Remainder of the Holden Mine Cleanup Process

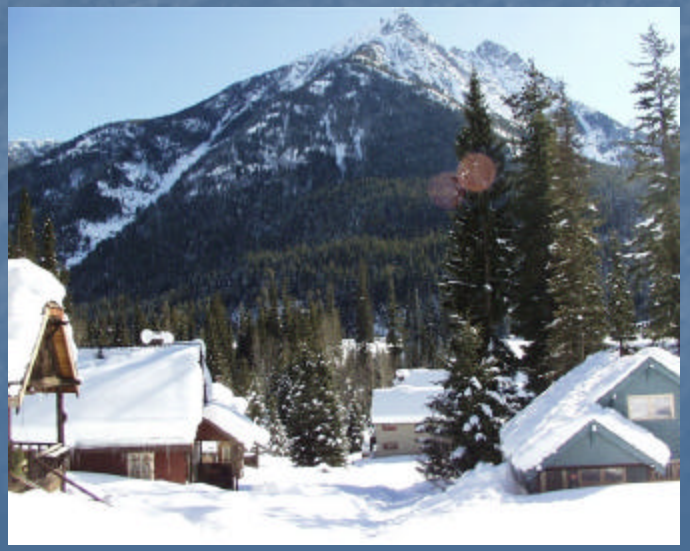
- Agencies plan to release the Proposed Cleanup Plan for public review in early June 2010 (4 public meetings).
- Agencies will select the Cleanup Remedy and issue ROD before end of calendar year 2010.
- During 2011 the Natural Resource Trustees and Intalco are expected to Reach a NRD Settlement.
- Preparation of Final Design and Consent Decree negotiations with Intalco during 2011 and 2012.

Next Steps & Schedule (continued)

- Potential for early actions in 2010/2011/2012 (in-mine bulkheads, dock upgrade at Lucerne, road improvement, & development of rock sources)
- Remedy construction is expected to begin spring 2013 and last 2-3 years.
- If Remedy construction is phased, the final phase (construction of the eastern barrier wall or other component) would occur no sooner than 5 years after completion of the initial phase of construction.
- Intensive remedy monitoring will continue until 5 years after final phase of remedy construction; followed by routine maintenance and monitoring for life of remedy (~200+ years).

Almost … the End…….

Close to The End.....



Getting Closer…

The End.....

Winter at Holden Village

www.fs.fed.us/r6/wenatchee/holden-mine/index