

Managing Mine Slimes and Other Lessons Learned

Jack Waite Mine Removal Action

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**CDM
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Introduction

- Project Team

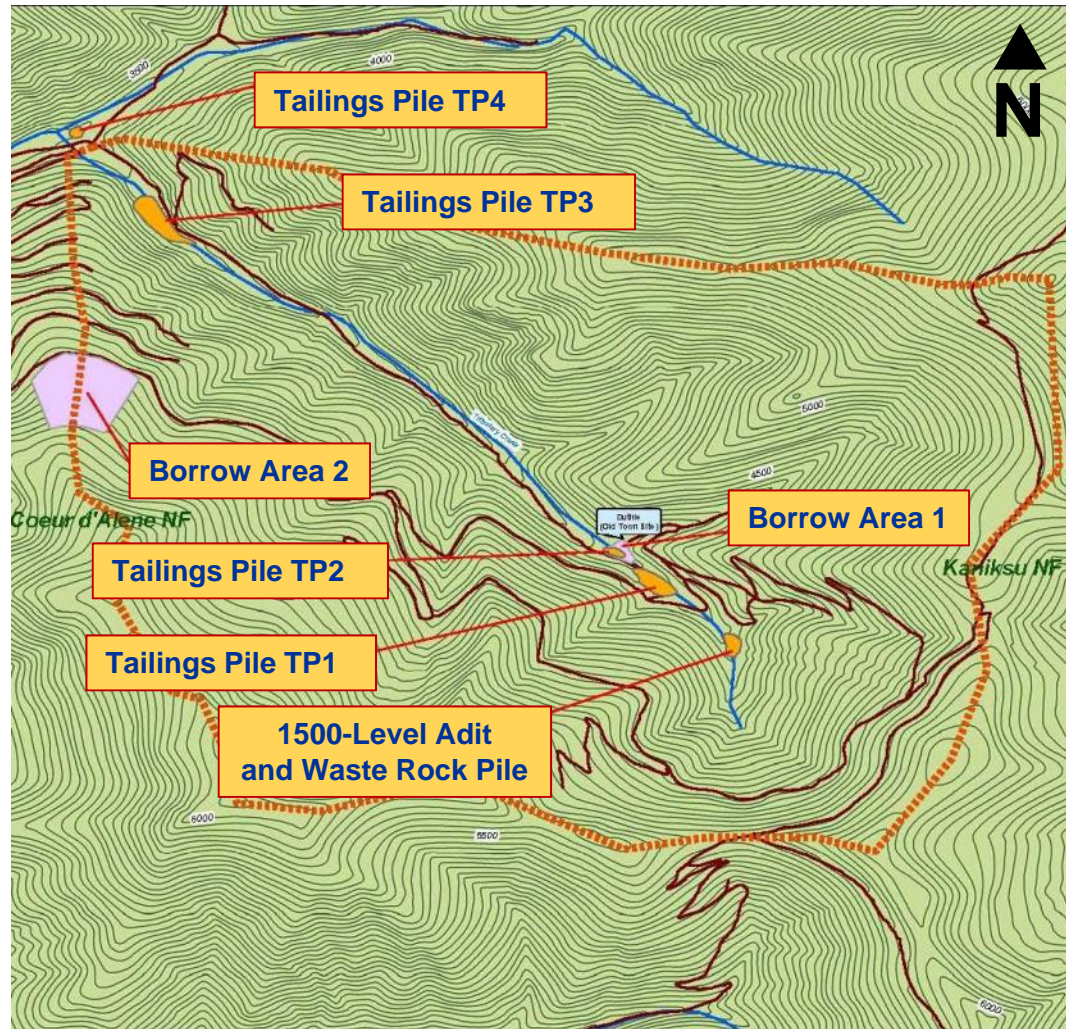
- Parametrix / CDM Smith; Engineering Design
- U.S. EPA Region 10; Lead Regulatory Agency
- U.S. Forest Service; Property Owner, Joint Lead Regulatory Agency
- U.S. Army Corps of Engineers – Seattle District; Construction Procurement and Administration
- Conti; Removal Action Contractor

- Site Features

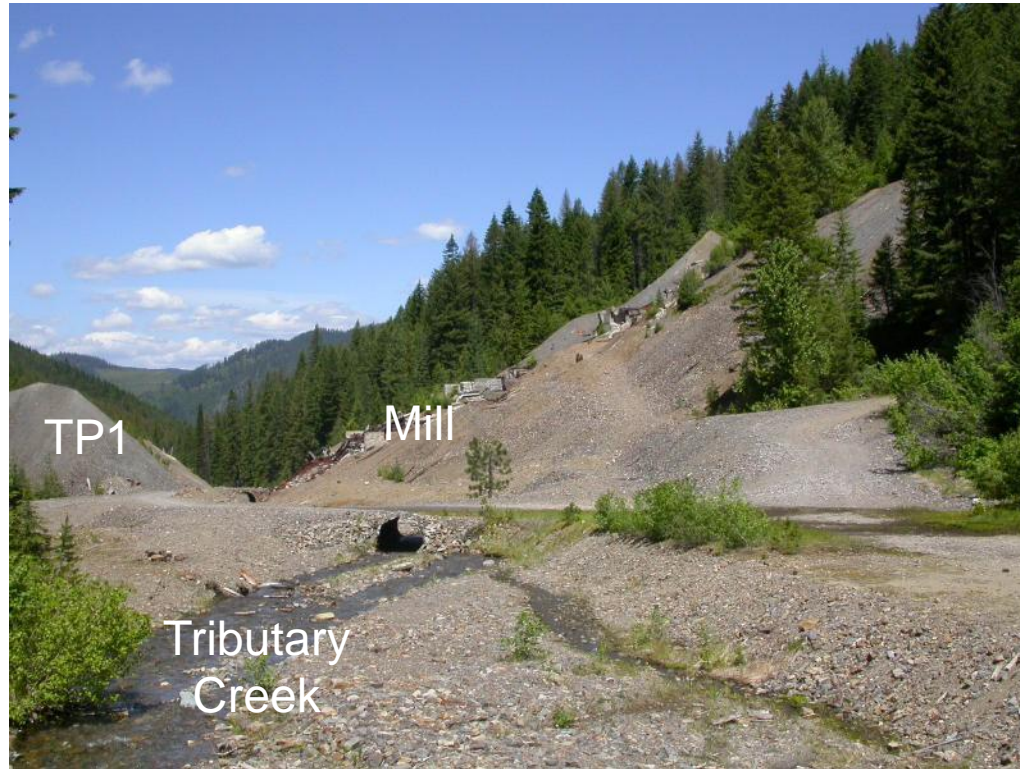
and 2011-2012 Removal Actions

- Removal of two tailings piles (TP1 and TP2) and Mill area in alluvial valley
- Consolidation to two repositories: TP3 and Borrow Area 2 (BA2)
- Rehabilitation of Tributary Creek

Jack Waite Mine Layout



Tailings Pile 1, Mill Area, & Tributary Creek



TP-1 (110,000 cy); Mill Area (14,000 cy); Alluvium (2,900 cy)

Tailings Pile 2



TP-2 (15,000 cy Tailings)

Materials Management & Restoration (MMR) Issues

- 2011 MMR Issues Encountered at the Jack Waite Site
 - Difficult material types
 - Additional waste volumes
 - Insufficient borrow soil gradation characterization
 - TP3 alluvial repository configuration
 - Remote high elevation site; limited construction season
- Issue Discussion
 - Design approach
 - 2011 construction issue
 - Solutions / lessons learned

Difficult Material Types

- Design Approach
 - Borings and cone penetrometers completed through tailings piles
- 2011 Construction Issue
 - TP2 slimes encountered in July 2011
 - Difficult to excavate material
 - Difficult to haul material – transportation caused separation of solids / liquids & spills
- Solutions / Lessons Learned
 - Temporary stockpile material to dewater, addition of Portland Cement (5%); transportable; achieved good compaction
 - For tailings piles, focus on potential volume of this material



Additional Waste Volumes

- Design Approach
 - Aerial survey / LiDAR data (2-ft. topographic contouring)
 - Test pit and boring extent / depth of mine wastes
 - Mine waste volumetrics developed using CAD 3D
 - Contingency volumes included (~30 Percent)
- 2011 Construction Issue
 - Additional waste rock volume at Mill Site (34,000 vs. 14,000 cy)
 - Additional tailings volume at TP2 (23,000 vs. 15,000 cy)
 - 2012 concerns with waste volume in Tributary Creek alluvium
- Solutions / Lessons Learned
 - Flexibility in repository design to allow additional capacity
 - Steep slopes and alluvial interface difficult to estimate



Insufficient Borrow Soil Gradation Characterization

- Design Approach

- Repository cover / rehabilitation area growth media and fill primarily developed from Borrow Area 2
- Test pits used to estimate depth of borrow soils
- Field observations / geotechnical data used to evaluate gradation (oversize vs. granular material)
- Borrow soil volumetrics developed using CAD 3D and gradation



- 2011 Construction Issue

- Significantly more oversize material - 19,000 cy vs. 11,000 cy
- Limited stockpiling areas / double handling in steep terrain

- Solutions / Lessons Learned

- Design approach should use grizzly / screening for oversize rock

TP3 Alluvial Repository Configuration

- Design Approach
 - EE/CA and Action Memorandum included TP2 repository located in Tributary Creek alluvial valley
 - Volume and cost constraints
 - Maximize mine waste in BA2 repository
 - Utilize low permeability cover to reduce infiltration
 - Utilize riprap toe armoring (100-yr event) ; HEC-RAS model
- 2011 Construction Issue
 - Tailings piping observed
- Solutions / Lessons Learned
 - Revised design to include toe drain system



Remote High Elevation Site

- Design Approach
 - Completed design / contracting process in 2010 (utilized \$1.2M ARAR funding)
 - Allowed for snow removal in bid for early mobilization
 - Allowed for flexibility in bid for one or two-season construction
- 2011 Construction Issue
 - Snow plowed in May; heavy precipitation in June; limited site construction until July
- Solutions / Lessons Learned
 - Field conditions can significantly impact schedule
 - Consider summer traffic on hauling



Questions

