

KELLY CAMP MINE

Colville National Forest
Ferry County, Washington



ENGINEERING EVALUATION/ COST ANALYSIS

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ACRONYMS AND ABBREVIATIONS

bcy	Bank cubic yard
lcy	Loose cubic yard
mg/kg	Milligram per kilogram
ABA	Acid base accounting
amsl	Above mean sea level
ARAR	Applicable or Relevant and Appropriate Requirements
BMP	Best management practice
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act
CFR	Code of Federal Regulations
COI	Chemical of interest
COPC	Chemical of potential concern
CPEC	Chemical of potential ecological concern
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
FP S&Gs	Forest Plan Standards and Guidelines
GS	Geological Survey
MDC	Maximum detected concentration
MDL	Method detection limit
MRL	Method Reporting Limit
MTCA	Model Toxics Control Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFS	National Forest System
NWFP	Pacific Northwest Forest Plan
O&M	Operations and maintenance
PRG	Preliminary Remediation Goal
PRP	Potentially Responsible Party
RAO	Removal action objective
RSL	Regional Soil Screening Levels
SHPO	State Historic Preservation Officer
SI	Site Inspection
SPLP	Synthetic precipitation leaching procedure
TCLP	Toxicity characteristic leaching procedure
TEE	Terrestrial Ecologic Evaluation
USDI	United States Department of the Interior
WAC	Washington Administrative Code
WDOE	Washington Department of Ecology
WRCC	Western Regional Climate Center

EXECUTIVE SUMMARY

URS Corporation (URS) prepared this Engineering Evaluation/Cost Analysis (EE/CA) for a proposed Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) removal action at the Kelly Camp Mine in northeastern Washington. This inactive mine is located within the Colville National Forest, in Ferry County, and approximately 11 miles north of the town of Republic (Figure 1). The Site is in the upper headwaters of the Trout Creek watershed.

Site features include: a main working/stope, consisting of two adits, two shafts and a waste rock pile, referred to as the upper waste rock pile (UWRP); a lower adit and waste rock pile, referred to as the lower waste rock pile (LWRP); a blast rock pile; and miscellaneous workings – seven open cuts, trenches, and pits excavated into native soil, and waste soil piles associated with these excavations.

A streamlined human health risk evaluation indicated risk to humans from exposure to waste rock is unlikely. A streamlined ecological risk evaluation identified risk ratios greater than five occurred for copper (252), lead (9.0), and silver (14), indicating the potential presence of a significant ecological risk from exposure to these metals in waste rock. These three chemicals pose the majority of potential ecological risk to ecological receptors exposed to Site waste rock. Soil cleanup criteria were developed using a combination of regulatory screening criteria, Site background concentrations, and regional background concentrations.

The UWRP and LWRP contain high concentrations of metals that exceed the soil cleanup criteria and are the primary contaminant sources at the Site. Surface water is present within the stope and is potentially a secondary contaminant source. Physical hazards (primarily fall hazards) are also associated with the stope and the miscellaneous workings. A removal action is necessary to eliminate direct exposure to waste rock and surface water and to prevent entry to the stope.

The scopes of removal actions evaluated in this EE/CA, therefore, focus on 1) eliminating direct contact with high concentrations of metals in the waste rock, 2) improving public safety by addressing physical hazards at the Site, and 3) attaining ARARs to the extent practical. Three removal action alternatives were evaluated for the Kelly Camp Mine:

- Alternative 1 – No Action
- Alternative 2 – Consolidation and On-Site Capping
- Alternative 3 – Excavation and Off-Site Disposal

Alternative 2 is recommended. To address risk associated with exposure to waste rock, the LWRP, consisting of approximately 156 bank cubic yards (bcy) of material, would be excavated and placed over the UWRP. The combined LWRP/UWRP would be capped in place using clean aggregate obtained from a nearby, off-Site source. The cap would be a minimum of one foot thick. The LWRP excavation area and the cap would be revegetated by placing a six-inch layer of compost over these areas and applying seed to the compost surface. Trees and brush cleared during the removal action would be used to generate slash and cover for seeded areas.

Physical hazards would be addressed by installing bat gates at the main and west entrances to the upper working/stope and at the lower adit entrance. The two eastern-most shafts at the upper working/stope would be backfilled with waste rock to eliminate fall hazards. The miscellaneous workings would be backfilled using waste soil piles associated with these feature to eliminate fall hazards.

Annual monitoring of the LWRP excavation area and the cap surface would be conducted for a minimum of five years to ensure these areas become revegetated and remain stable, and to identify and eliminate infestations of non-native or invasive plant species.

The total estimated cost for the recommended alternative is **\$158,000**.

1.0 INTRODUCTION

URS Corporation (URS) was contracted by the United States Department of Agriculture, Forest Service (Forest Service) to perform an Engineering Evaluation/Cost Analysis (EE/CA) for a contemplated non-time critical removal action at the Kelly Camp Mine (the Site) on the Colville National Forest in northeastern Washington.

- This EE/CA is being performed by the Forest Service under its cleanup authorities (42 USC 9604(a), 7 Code of Federal Regulations (CFR) 2.60(a)(39) and Federal Executive Order 12580). The purpose of this EE/CA is to select an alternative to minimize or eliminate any release or threat of release of a hazardous substance into the environment or impact on public health and welfare as outlined in 40 CFR 300.415(b)(2)(i-viii).
- This EE/CA was prepared utilizing the U.S. Environmental Protection Agency (EPA) “*Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA*” and in accordance with the provisions of National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300.415(b)(4)(i).
- The purpose of a removal action is to “abate, prevent, minimize, stabilize, mitigate or eliminate the release or the threat of a release” (40 CFR 300.415). The EE/CA for a removal action is intended to:
 - o Satisfy environmental review requirements for removal actions;
 - o Satisfy administrative record requirements for documentation of removal action selection; and
 - o Provide a framework for evaluating and selecting alternative technologies.
- To meet those purposes, this EE/CA identifies objectives for the removal action and evaluates the effectiveness, implementability, and cost of three alternatives that may satisfy these objectives.
- The primary sources of data used to evaluate Site conditions and to develop removal action alternatives are the Site Inspection (SI) and Streamlined Human Health and Ecological Risk Assessment prepared by URS (2008), the Abbreviated Preliminary Assessment (APA) prepared by the Forest Service (2004), and a data gap investigation conducted as part of this EE/CA.

2.0 SITE CHARACTERIZATION

A detailed characterization of the Site is presented in the SI (URS, 2008); please refer to that report for more information. A vicinity map is provided in Figure 1, and a map showing primary Site features is provided in Figure 2. A photographic log of relevant Site features is provided in Appendix A.

2.1 Site Description

- The Site is an inactive mine located within the Colville National Forest, in Ferry County, Washington. It is located approximately 11 miles north of the town of Republic, in a forested area in the SW ¼ of Section 9, Township 38 North, Range 32 East.
- The Site is found on the USDI Geological Survey (GS) 7 ½ Minute Quadrangle Map - Bodie Mountain (GS, 1992).
- As shown on the Site Vicinity Map (Figure 1), this Site is situated approximately 8 miles west of Curlew Lake. The access road to the mine is approximately 0.5 mile on the 391 spur of Forest Service Road 2148 (Figure 2).
- Site features include the following:
 - o Main working/stope.

- o Upper waste rock pile (UWRP) associated with the main working/stope.
- o Lower adit.
- o Lower waste rock pile (LWRP) associated with the lower adit.
- o Blast rock pile.
- o Miscellaneous workings – seven open cuts, trenches, and pits excavated into native soil, and waste soil piles associated with these excavations.

2.2 Topography and Climate

- The area surrounding the mine is characterized by hilly to mountainous topography and narrow stream valleys. The stream valleys are generally oriented in a north-south direction.
- The mine is located at an approximate elevation of 4,600 feet amsl on the south side of Kelly Mountain.
- Area climate is temperate, characterized by warm to hot summers and cold winters. Winter precipitation falls predominantly as snow.
- A summary of the climate indicators is provided below and is based on data from the Western Regional Climate Center's Desert Research Institute (WRCC DRI, 2007) for Republic, Washington.
 - o The mean annual precipitation is 16.47 inches.
 - o The mean maximum temperature for Republic is 55.8 degrees Fahrenheit (F), with an average maximum temperature of 81.5 F in July.
 - o The mean minimum temperature is 30.7 F with the average minimum of 15.0 F occurring December.

2.3 Surrounding Land Use and Populations

Land uses in areas surrounding the Site include recreational use (e.g., camping, hiking, hunting), logging, and cattle grazing/management. The Site is surrounded by rural properties that are primarily in agricultural use; the nearest approximately five miles away. The Site is currently inactive and access to the abandoned mine Site is unrestricted and accessible by public roads. The town of Republic had 941 inhabitants in 2008 (U.S. Census Bureau, 2008). The nearest known residence is approximately five miles away.

2.4 Sensitive Environments

No sensitive environments (as defined in Washington Administrative Code [WAC] 173-340-200) were observed on-Site or in its immediate vicinity such as:

- Wetlands, critical habitat for endangered or threatened species, national or state national wildlife refuge, wild or scenic river, rookery, riparian area, big game winter range, and critical habitat, breeding, or feeding area for fish or shellfish.

A search by the Washington Department of Fish and Wildlife found no priority habitat near the Site.

- There is no grizzly bear or deer winter range habitat within at least 4 aerial miles of the Site (Colville National Forests GIS Data Dictionary).
- The nearest known sensitive environments are National Wetland Inventory wetlands located 1 mile east and west of the Site.

- The nearest winter caribou habitat is located 1 mile away, coincident with the wetlands (Colville National Forests GIS Data Dictionary).
- The nearest pine marten/pileated woodpecker habitat is located 0.21 miles southwest of the Site, near Trout Creek (Colville National Forests GIS Data Dictionary).

2.5 Data Gap Investigation

URS conducted a data gap investigation at the Site on July 7 and 8, 2009. The objectives of the data gap investigation were to:

- Collect additional soil samples in the LWRP to characterize the magnitude and extent of metals¹ in the waste rock and determine if a removal action is warranted.
- Evaluate if samples taken outside of identified waste rock piles are affected by or associated with waste rock from the mine Site, and collect samples for laboratory analysis if needed.
- Identify potential sources of aggregate for capping waste rock and collect aggregate samples for laboratory analysis.
- Examine the conditions of the Site, aggregate source areas, and the condition of the interconnecting Forest Service roads that would be used as haul roads during a removal action.

The results of the data gap investigation are present in the following subsection.

2.5.1 LWRP Characterization

- Ten soil samples, designated L-1 through L-10, were collected from the LWRP during the data gap investigation (Figure 4).
- Soils within the LWRP generally show higher concentrations of chromium and nickel than samples from the UWRP, areas outside of waste piles, or background soils (Table 2). Arsenic was also elevated compared to areas outside of waste piles and background soils.
- Arsenic exceeded one or more human health screening criterion (Table 3).
- Arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, selenium, and zinc exceeded one or more ecological screening criterion (Table 3).

2.5.2 Areas Outside of Waste Rock Piles

- Seven other lesser exploration cuts, trenches, and pits and associated waste soil piles are located west of the blast rock pile.
- The total estimated volume of waste soil associated with the workings is on the order of 10 bcy. Waste soil generally consisted of gravel- to cobble-sized rock fragments mixed with soil. In general, it appeared that the cuts, trenches, and pits were excavated into native, colluvial soils, and did not include hard rock excavation.
- Twenty soil samples were collected from outside the waste rock piles during the SI (Figure 4). These samples were designated RS-11, RS-12, RS-14, S-15 through S-29, S-34, and S-35. Four additional samples, designated O-1 through O-4, were collected during the data gap investigation. These were collected in the same vicinity as SI samples RS-12, S-18, S-21, and S-34, as shown on Figure 4.
- The RS samples were collected on or adjacent to existing Site access roads. The access roads

¹ In this EE/CA, the term “metals” is used to refer collectively to elements that are true metals as well as other elements that do not exhibit all the properties of true metals such as arsenic, antimony, and selenium.

appear to have been constructed by excavation and grading of native colluvial soils. The S samples were generally collected from what appeared to be relatively undisturbed native soils adjacent to cuts, trenches, and pits or from small waste soil piles adjacent to excavated features.

- Soils within areas outside the waste rock piles show elevated concentrations of nearly all metals compared to background samples (Table 2). The soils also showed elevated concentrations compared to the LWRP, except for arsenic, chromium, and nickel, which were higher in the LWRP. Finally, the soils also showed slightly to moderately elevated concentrations of barium, beryllium, chromium, mercury, and nickel compared to the UWRP.
- Arsenic and cadmium exceeded one or more human health screening criteria (Table 3).
- Arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, silver, and zinc exceeded one or more ecological screening criteria (Table 3).
- Since the various cuts, trenches, pits, and access roads appear to have been excavated into native, colluvial soils, metals concentrations in the associated soil samples may be representative of naturally-occurring metals in the colluvial soils.

2.5.3 Aggregate Source Assessment

Assessment of the aggregate sources included the following activities:

- Identification of potential sources of aggregate for capping waste rock and collection of aggregate samples for laboratory analysis.
- Examination of the conditions of the aggregate source areas and the condition of the interconnecting Forest Service roads that would be used as haul roads during a removal action.

With the assistance of the Forest Service, four potential aggregate source sites were identified on Forest Service lands in close proximity to the mine workings.

- These potential sources are referred to as Fill #1, Fill #2, Cow Camp, and Storm King, and are shown on Figure 5.

In addition to observing access to and conditions of each source site, five grab samples were collected from each site and composited in the field into a single sample.

- The composite sample was analyzed for total metals and mercury.
- The analytical results are provided on Table 3.

Fill #1

- Fill #1 is located northeast of the Site, about 2 miles away on Forest Service roads. See photo #21 in Appendix A.
- The road to Fill 1 Area is suitable for haul trucks and heavy equipment.
- The Fill #1 site is relatively flat and is approximately 250 feet long and 100 feet wide.
- There are three aggregate piles at the Fill #1 site. The first is vegetated with grasses and consists of sandy silt with greater than 40 percent cobbles. The second is heavily vegetated and consists of sandy silt with greater than 30 percent gravels and cobbles. The third is mostly unvegetated and consists of silt loam with greater than 60 percent gravels.
- The ground surface throughout the Fill #1 site is gravely sandy silt. The thickness of the material is unknown, but is assumed to be several feet.

- Excavation of 1 foot of soil from across the 250-foot by 100-foot area would generate approximately 925 bcy of soil and together with the three soil piles at the site, the volume of material available as a capping material could exceed 1,000 cubic yards.
- Five grab samples were collected from the ground surface near each aggregate pile and from the ground surface from within the middle of the Fill #1 site. The grab samples were composited into a single sample for laboratory analysis.
- With the exception of arsenic, all other metals were not detected or the detected concentrations were below human health and ecological screening criteria. The arsenic concentration (2.34 mg/kg) was below the Washington state background concentration (7.61 mg/kg) and similar to the Kelly Camp Site background concentration (2.1 mg/kg). Based on this data, the Fill #1 aggregate material is suitable for use as capping material at the Site.

Fill #2

- Fill #2 is located northeast of the Site, about 2 miles away on Forest Service roads. See photo #22 in Appendix A.
- The road to the Fill #2 area is suitable for haul trucks, trailers, and other heavy equipment.
- The Fill #2 site is relatively flat and is approximately 200 feet long and 100 feet wide.
- A creek is located about 200 feet downhill from the Fill #2 site. The hill slope between the edge of the site and the creek is forested.
- The ground surface throughout the Fill #2 site is gravely sandy silt. The thickness of the material is unknown, but is assumed to be several feet. The ground surface is moderately vegetated with grasses.
- Excavation of 1 foot of soil from across the 200-foot by 100-foot area would generate approximately 740 bcy of capping material.
- Five grab samples were collected from the ground in the middle of the Fill #2 site and the site perimeter. The grab samples were composited into a single sample for laboratory analysis.
- With the exception of arsenic, barium, and manganese, all other metals were either not detected or the detected concentrations were below applicable human health and ecological screening criteria. The arsenic concentration was below the Washington state background concentration and similar to the Kelly Camp Site background concentration. The barium and manganese concentrations were less than the minimum Site-specific background concentrations. Based on this data, the Fill #2 aggregate material is suitable for use as capping material at the Site.

Cow Camp

- Cow Camp is located north of the Site, about 6.8 miles away on Forest Service roads. See photo #23 in Appendix A.
- The road to the Cow Camp site is rough, but it is suitable for haul trucks, trailers, and heavy equipment.
- The Cow Camp site consists of a large, terraced gravel pile, approximately 100 feet tall and 150 feet wide. The gravel consists of sandy silt with abundant gravels and cobbles.
- The gravel pile appears to have been excavated from further upslope, where a large, steep excavated escarpment is present above the gravel pile.
- The gravel pile is vegetated by small conifer trees, flowers, and grasses.

- Excavation of the material from the pile would need to be conducted in a manner that does not oversteepen the escarpment, cause slope instability, or promote erosion of the hill slope. The slope to the east of the pit may be the best choice for excavation, as it will not likely oversteepen the gravel pile.
- Careful excavation of material from the Cow Camp site could yield up to 500 bcy of material for capping.
- Five grab samples were collected from across the gravel pile and composited into a single sample for laboratory analysis.
- With the exception of arsenic, analyzed metals were not detected or the detected concentrations were below applicable human health and ecological screening criteria. The arsenic concentration was below the Washington state background concentration and similar to the Kelly Camp Site background concentration. Based on this data, the Cow Camp aggregate material is suitable for use as capping material at the Site.

Storm King

- Storm King is south of the Site, about 10.7 miles away on Forest Service roads. See photo #24 in Appendix A.
- The road is generally smooth and wide and is suitable for haul trucks, trailers, and heavy equipment.
- The Storm King site consists of a steep road cut about 450 feet long and 50 feet high.
- Material exposed by the road cut consists of sandy soil with approximately 15 percent cobbles and boulders and less than 5 percent fine-grained material.
- The road cut is sparsely vegetated. Areas upslope of the road cut are vegetated by conifer forest.
- Excavation of material from the road cut could cause oversteepening of the road cut slope unless the top of the excavation was extended back into undisturbed forest.
- Careful excavation of material from the Storm King site could yield in excess of 500 bcy yards of material for capping.
- Five grab samples were collected from across the face of the road cut and composited into a single sample for laboratory analysis.
- With the exception of arsenic and manganese, analyzed metals were not detected or the detected concentrations were below applicable human health and ecological screening criteria. The arsenic concentration was below the Washington state background concentration and the Kelly Camp Site-specific background concentration. The manganese concentration was less than the minimum Site-specific background concentration. Based on this data, the Storm King aggregate material is suitable for use as capping material at the Site.

2.6 Source, Nature, and Extent of Contamination

The source, nature and extent of contamination at the Site are summarized in the following subsections by media type. Refer to the SI (URS, 2008) for more detailed information.

2.6.1 Surface Water

- The only surface water present at the mine Site is accumulated water in the main working/stope. This surface water is present in two small ponds and one vertical shaft. Each pond is several feet deep and the water within the vertical shaft is approximately 10 to 15 feet deep.

- The water is unlikely to be used as a drinking water source by people. Contact with the water is most likely to be incidental and infrequent dermal contact.
- The water does not provide aquatic habitat and is most likely only used as a drinking water source for the wood rat(s) living in the main working/stope.
- Two water samples were collected from the ponded water for laboratory analysis (Table 1).
- Initial screening of water sample analytical data using conservative generic screening criteria found that potential human health risk from contact with the water was negligible and no chemicals of potential concern (COPCs) were identified.
- Aluminum, barium, and copper detected in the water exceeded conservative screening criteria for aquatic life and are considered CPECs.
- The only CPEC in mine water with a risk ratio greater than five was copper. Further assessment of copper concentrations using a toxicity reference value (TRV) for mammals ingesting water did not identify a potentially unacceptable ecological risk.
- This pathway does not appear to pose a risk and further assessment of this pathway is not required.
- The surface water pathway is addressed by gating or backfilling of mine openings, which will eliminate exposure of humans and larger animals to mine water pools.

2.6.2 Groundwater

- Although groundwater was not sampled at the Site, its completeness as an exposure pathway was considered.
- Groundwater aquifers likely are present beneath the Site within near surface alluvium and/or glacial deposits and bedrock. A subsurface groundwater study was not conducted as part of the SI.
- There are no wells located within the Site's watershed boundaries. The closest well is located approximately 2 miles to the south of the Site.
- Human receptors are not likely to be exposed to groundwater by ingestion.
- Groundwater is considered to be an insignificant exposure media for ecological receptors since it does not daylight outside of the mine near the Site. The nearest natural surface water to the Site is the North Fork Trout Creek, approximately 1,700 feet to the south.
- With the possible exception of future workers excavating the area, no human or ecological exposures to groundwater are anticipated.
- The groundwater pathway was considered to be incomplete for potential human and ecological receptors and further assessment of this pathway is not required.
- The groundwater pathway is not addressed further in this EE/CA.

2.6.3 Air

- Air quality at the Site has not been characterized and no air samples were collected during the SI. The most likely source of air contamination at the Site is windblown dust particulates from the waste rock piles.
- The air pathway is complete because metal-impacted soil is concentrated at the surface where human and ecological receptors could be exposed to particulate matter by inhalation.

- Since inhalation risk stems from particulates released from contaminated soil, this pathway was addressed in the risk assessment as part of the soil exposure pathway. In the risk assessment, risk from inhalation of contaminated soils was calculated through the receptor-specific modeling.
- The findings of this receptor-specific recreational user model suggested that unacceptable human health or ecological risks are unlikely to occur from the inhalation pathway. Further assessment of this pathway is not required.
- The air pathway is not addressed further in this EE/CA.

2.6.4 Mine Waste and Soil

Background Soil

- Ten background soil samples were collected during the SI (Figure 3). The results indicated the following:
 - o Two metals (selenium and silver) of the twelve analyzed were not detected above Method Reporting Limits (MRLs) (Table 2).
 - o Arsenic was detected at only one background sample location (Table 2) and was the only metal that exceeded a human health screening criterion (Table 3) in background soils.
 - o Site-specific background soil concentrations of barium, cadmium, chromium, copper, manganese, and zinc concentrations exceeded at least one ecological screening criterion (Table 3).
 - o Site-specific background concentrations were calculated using the 90th percentile of the ten background samples or half of the MRL if the Chemical of Interest (COI) was not detected in background samples.
 - o The Site-specific background concentrations are used in the EE/CA to assist with the selection of cleanup criteria for the Site.

UWRP Soil

- The UWRP consists primarily of waste rock excavated during underground operations at the main working/stope.
- The UWRP covers an area of about 0.34 acre.
- The total estimated volume of the UWRP is about 427 bcy. The waste rock is poorly sorted and composed of sand- to cobble-sized fragments.
- Five soil samples were collected from within the UWRP during the SI (Figure 4). These samples were designated S-30, S-31, S-32, S-33 and RS-13.
- Soil samples collected from the UWRP generally have higher concentrations of arsenic, cobalt, copper, lead, manganese, and silver than soil samples from the LWRP, areas outside of waste piles, and background soils (Table 2).
- Arsenic, cadmium, and lead exceeded one or more human health screening criterion (Table 3).
- Arsenic, barium, cadmium, cobalt, copper, lead, manganese, selenium, silver, and zinc exceeded one or more ecological screening criterion (Table 3).

LWRP Soil

- The LWRP consists primarily of waste rock excavated during underground operations at the lower adit.

- The LWRP covers an area of about 0.1 acre.
- The total estimated volume of the LWRP is about 156 bcy. The waste rock pile is comprised of gravel- to cobble-sized rock fragments.
- Only one soil sample, S-36, was collected from the LWRP during the SI. Further characterization of the LWRP was completed during the data gap investigation, the results of which are described in Section 2.5.1 above.

Blast Rock

- A blast rock pile is located to the west of the UWRP. The volume of the blast rock pile is approximately 718 bcy. The size of the material within the pile ranged from cobble-sized (near the southern end of the pile) to 4- to 5-foot diameter blocks.
- Soil material from the blast rock pile was not available for sampling and analysis. A whole rock sample was collected for metals analysis, as described further in the acid-base accounting (ABA) section below.

Acid-Base Accounting

Waste rock samples were collected to estimate the acid leachate generation potential and determine if metals leaching from the waste rock could impact surface water or groundwater quality. The results of the waste rock samples were not used in the risk assessment since the size of the rock would prevent uptake by humans or ecological receptors. The waste rock samples were collected from the following locations:

- WR-1 – main working/stope waste rock pile.
- WR-2 – waste rock generated from the various workings west of the blast rock pile.
- WR-3 – lower adit waste rock pile.
- WR-4 – blast rock pile.

The whole rock samples were crushed at the laboratory and analyzed for metals.

- Waste rock metals results are summarized on Table 4.
- The metal results from waste rock indicate significantly elevated concentrations of copper and manganese in WR-1. Other metals exceeding one or more screening criterion include arsenic, cadmium, chromium, lead, selenium, silver, and zinc.
- Waste rock sample WR-2 contained concentrations of arsenic, cadmium, chromium, copper, lead, manganese, selenium, and zinc above one or more screening criteria.
- In waste rock sample WR-3, chromium, copper, manganese, selenium, and zinc exceeded one or more screening criteria.
- In waste rock sample WR-4, arsenic, chromium, copper, manganese and zinc were elevated above one or more screening criteria.

The crushed waste rock samples WR-1 through WR-3 were analyzed for their ABA properties.

- Sample WR-1 has a no potential for generating acid mine drainage (AMD), but sulfate concentrations suggest that some sulfide oxidation has occurred and secondary byproducts are stored in the UWRP.

- Sample WR-2 has no potential for generating AMD.
- Sample WR-3 has no to a low potential for generating AMD.

The crushed waste rock samples WR-1 through WR-4 were analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) and Synthetic Precipitation Leaching Procedure (SPLP). The results are summarized in Table 5.

- None of the rock samples exhibit the characteristic of toxicity as defined by 40 CFR 261.24 since the TCLP leachate concentrations do not exceed the maximum concentrations laid out in Table 1 of Section 261.24.
- Metal concentrations in TCLP leachate were generally higher than those in SPLP leachate.
- Two chemicals (cobalt and lead) were detected in TCLP leachate but not in SPLP leachate.
- The maximum detected concentrations (MDCs) of the SPLP results were compared to leachate screening criteria. No detected concentrations in SPLP leachate exceeded these screening criteria.
- The ABA, TCLP, and SPLP results suggest that groundwater is unlikely to be impaired by leachate from waste rock and blast rock piles.

Mine Structures and Debris

- There are no structures associated with the main working/stope, although wood debris and a wooden ladder are present within the working/stope.
- A 10-foot-square, collapsed wooden structure is located 15 to 20 feet south of the lower adit on a portion of the waste rock pile. Other wood debris is present within the opening to the lower adit.
- A powder magazine is located approximately 325 feet southeast of the lower adit and consists of a small bedrock excavation with associated concrete work and wood debris.

2.7 Risk Assessment Conclusion

URS completed a streamlined human health and ecological risk assessment of the Kelly Camp Site to evaluate risks associated with exposure to mining-related contaminants at the Site (URS, 2008). Analytical data and other information presented in the SI were used in the risk calculations. Analytical data for the LWRP collected as part of the data gap investigation were compared to human health and ecological screening criteria, but calculation of actual risk was not conducted on this data set. Results of the streamlined risk assessment indicated the presence of potentially significant risks to ecological receptors but not human receptors at the Site.

2.7.1 Human Health Risk Assessment

- Mine water and soil comprise the media of interest for human health. To determine which metals should be evaluated further in the risk assessment, the water and soil results were compared to Site-specific background concentrations and generic screening criteria developed for industrial and unrestricted land uses.
 - o Since samples of mine water did not exceed human health-based screening criteria, no mine water COIs were considered to be human health COPCs.
 - o Of the fourteen metals measured in soil during the SI and data gap investigation, the 95 percent upper confidence limit (UCL) of the mean Site concentrations of only arsenic and cadmium exceeded human health generic screening criteria.
 - o Arsenic and cadmium were considered COPCs and evaluated further in the risk assessment.

- Carcinogenic risk and non-carcinogenic hazard were calculated for adult and child recreational users exposed to arsenic and cadmium in Site soils.
- Human health risks are considered to be potentially unacceptable if the risk estimates for carcinogenic endpoints are greater than 1E-06.
 - o Since the carcinogenic risk estimate did not exceed 1E-06, the findings suggest that no unacceptable carcinogenic risks to recreational users are likely to occur from dermal exposure, inhalation, and incidental ingestion pathways.
- Human health risks are considered to be potentially unacceptable if the hazard indices for non-carcinogenic endpoints are greater than one.
 - o Since the hazard index for non-carcinogenic endpoints did not exceed one, the findings suggest that no unacceptable non-carcinogenic risks to recreational users are likely to occur from dermal exposure, inhalation, and incidental ingestion pathways.

2.7.2 Ecological Risk Assessment

- Potentially contaminated exposure media for ecological receptors include Site soils and mine waste, and Site mine water.
 - o Potentially complete pathways for immobile receptors (e.g., plants and soil biota) include direct exposure to Site surface soils and mine wastes.
 - o Potentially complete pathways for mobile receptors (e.g., birds and mammals) include incidental ingestion of surface water, food web exposure to surface water, incidental ingestion of surface soil and mine wastes, and food web exposure to surface soil and mine waste.
- Mine water results were initially compared to readily available generic screening criteria developed for protection of aquatic life (Washington Department of Ecology [WDOE] aquatic life criteria) (WAC, 2006) and preliminary remediation goals (PRGs) for ecological endpoints (Efroymson et al., 1997)).
- Soil concentrations were initially compared to generic screening criteria developed for protection of terrestrial plants, soil biota, and wildlife (Model Toxics Control Act [MTCA] Table 749-3) (WDOE, 2001b).
- Ecological COIs with concentrations in soil and mine water that exceeded screening criteria or with method detection limits (MDLs) or MRLs that exceeded generic screening criteria became chemicals of potential ecological concern (CPECs). These CPECs are summarized below:
 - o CPECs in mine water included aluminum, barium, beryllium, boron, cadmium, copper, lead, lithium, mercury, selenium, silver, and thallium. Only aluminum, barium, and copper were present at concentrations that exceeded an ecological screening criterion.
 - o CPECs in soil included arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, selenium, silver, and zinc.

The CPECs identified by the generic screening were further assessed through an evaluation of risk ratios.

- If the risk ratio is greater than one, then the exposure point concentration exceeds the screening criterion. Risk ratios greater than one indicate the potential presence of an unacceptable risk to threatened or endangered species, which are protected at the individual level.
- Risk ratios greater than five indicate the potential presence of an unacceptable risk to populations of ecological receptors. This level of protection is considered most appropriate for non-threatened or endangered species.

- Multiple risk ratios may occur for a single chemical when an exposure point concentration is compared to more than one generic screening criterion.
- Evaluation of Risk Ratios in Mine Water
 - o Since access to mine water is limited and the pools do not provide habitat for aquatic life, ecological exposure is limited to mammals that can enter the stope.
 - o One chemical in mine water (copper) had a risk ratio greater than five. This chemical was further assessed by locating a toxicity reference value (TRV) specific for mammal ingestion of water containing copper. Copper concentrations did not exceed this TRV, suggesting that there is no potential unacceptable risk to ecological receptors exposed to the mine water.
 - o For this reason, potential ecological risk from ingestion of mine water is considered to be low.
- Evaluation of Risk Ratios in Soil
 - o Of the twelve soil CPECs, several metals had Site concentrations that were similar to background concentrations and therefore were unlikely to pose ecological risk significantly above background. These metals were not further considered in the risk assessment.
 - o Metals with risk ratios between one and five were considered unlikely to result in significant ecological risk to populations of non-threatened and non-endangered species.
 - o Risk ratios greater than five occurred for copper (252), lead (9.0), and silver (14), indicating the potential presence of a significant ecological risk from exposure to these metals in soil. These three chemicals pose the majority of potential ecological risk to ecological receptors exposed to Site soil.

2.7.3 Physical Hazards

- There are several physical hazards associated with the main working/stope. These include:
 - o Open shafts that could result in a fall of 10 to 20 feet.
 - o Slips or trips that could result in falls when standing at the shaft openings.
 - o Unstable rock within the shaft and stopes that could give way and cause someone to fall into the water ponds.
- The physical hazards associated with the lower adit include tripping or falling within the adit or the collapse of mine timbers used to support the opening.
- The physical hazards associated with the blast rock include unstable rock that could give way and cause an injury.
- The physical hazards associated with miscellaneous workings and structures include:
 - o Falling, as several of these explorations were covered with vegetation during the time of the Site visit and only became visible once standing on the side of the exploration, and
 - o Trips or slips leading to falls, due to loose rock on the sides of the workings.
- A former wooden powder magazine structure that is unstable and may collapse is also considered a physical hazard.

3.0 SITE CLEANUP CRITERIA

There are two general types of cleanup criteria:

- (1) Applicable or Relevant and Appropriate Requirements (ARAR), and

- (2) Risk-based cleanup criteria developed from human health and ecological risk equations using acceptable risk levels and Site-specific factors.

ARARs are “applicable” or “relevant and appropriate” federal and state environmental requirements. Applicable requirements include cleanup standards and other substantive requirements, criteria, or limitations promulgated under federal or state laws that apply to hazardous substances and removal actions at the Site. Relevant and appropriate requirements are not applicable to the Site but may be suitable for use because they address issues or problems sufficiently similar to those at present at the Site. In addition to ARARs, federal and state environmental and public health guidance and proposed standards that are not legally binding but may prove useful are “to be considered” standards.

The results of the SI indicate that the only potentially significant source of risk at the Site is from the exposure of ecological receptors to Site soil. The following discussion of ARARs and proposed cleanup criteria, therefore, focuses on soil as the only media of concern at the Site. ARARs and proposed cleanup criteria for soil are discussed below and summarized in Table 6.

3.1 Applicable or Relevant and Appropriate Requirements

ARARs are used to:

- (1) Evaluate the extent of Site cleanup needed;
- (2) Scope and develop removal action alternatives; and
- (3) Guide the implementation and operation of the preferred alternative.

The NCP (40CFR 300.415(j)) establishes that a removal action shall “to the extent practical, considering the exigencies of the situation, attain ARARs under federal environmental or state environmental facility siting laws.”

To determine whether compliance with ARARs is practicable, two factors are specified in 40 CFR 415(j):

- Urgency, and
- Scope of the removal action.
 - o The scope of the removal action is often directed at minimizing and mitigating potential hazard rather than totally eliminating the hazard; even though a particular standard may be an ARAR for a particular medium, it may be outside the scope of the immediate problem the removal action is addressing.

A comprehensive list of potential ARARs generated and evaluated for the Site is presented in Appendix B. A request for any additional Washington state-specific ARARs was submitted to the WDOE during preparation of this EE/CA; however, no response was received. The ARARs were used to determine the design specifications and performance standards for the project. They are grouped as federal or state of Washington ARARs, and are identified by a statutory or regulatory citation, followed by a brief explanation of the ARAR, and whether the ARAR is applicable (i.e., relevant and appropriate).

- Administrative requirements are not ARARs and thus do not apply to actions conducted entirely on-Site. Administrative requirements are those that involve consultation, issuance of permits, documentation, reporting, record keeping, and enforcement.
- The CERCLA program has its own set of administrative procedures, which assure proper implementation of CERCLA. The preamble to the final NCP states that the application of additional or conflicting administrative requirements could result in delay or confusion.
- Provisions of statutes or regulations that contain general goals that merely express legislative intent about desired outcomes or conditions, but are non-binding, are not ARARs. In accordance with Section 121(e) of CERCLA, no permits are required for the removal action.

Potential key chemical-, action-, and location-specific ARARs for a removal action at the Kelly Camp Site include, respectively:

- **Chemical-specific Soil Standards:**
 - o Washington Model Toxics Control Act (MTCA) Industrial Soil Cleanup Levels – Human Receptors (WAC Chapter 173-340, Tables 740-1 and 745-1).
 - o MTCA Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals (WAC Chapter 173-340, Table 749-3).
 - o EPA Industrial Soil Regional Screening Levels (RSLs) (EPA, 2009).
 - o EPA Ecological Soil Screening Levels (EPA, 2008).
- **Solid/Dangerous Waste (Solids) Disposal Requirements:**
 - o Washington MTCA Terrestrial Ecologic Evaluation (TEE) Criteria (WAC Chapter 173-340).
 - o Washington State Hazardous Waste Management Act and Dangerous Waste Regulations (WAC Chapter 173-303).
 - o Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Subtitle C (40 CFR Part 261 to 279).
- **Forest Plan Standard and Guidelines (FP S&Gs):**
 - o Colville National Forest Land and Resource Management Plan (LRMP) (Forest Service, 1988), as amended by the Forest Service (1995).
 - o Other Standards and Guidelines may also be potentially applicable, for example, measures identified for the protection of threatened, endangered or sensitive species.

Many potential key location-specific and some action-specific ARARs will be considered during the design phase of the removal, after the removal decision identifies the selected alternative and removal activities.

3.1.1 Soil Standards

The soil ARARs are based on Washington state and federal standards for the protection of human health and the environment and are summarized in Table 6. Several COIs in the background soil and waste rock at the Site exceeded the soil quality ARARs:

- Eight COIs in background soil exceeded human health or ecological ARARs:
 - o Arsenic exceeded human health ARARs.
 - o Barium, cadmium, chromium, copper, manganese, and zinc exceeded ecological ARARs.
 - o The MRL for selenium exceeded ecological ARARs.
- The MDC of twelve COIs in waste rock at the Site exceeded human health or ecological ARARs:
 - o Arsenic, cadmium, and lead exceeded human health ARARs.
 - o Arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, selenium, silver, and zinc exceeded the ecological ARARs.

3.1.2 Solid/Dangerous Waste (Solids) Disposal Requirements

These ARARs 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. All substantive requirements for closure and post-closure of limited purpose landfills (WAC 173-350-400) are potential ARARs (WAC 173-340-71

0[7] [c]). The waste rock/soils at the Site are landfills that contain solid waste and are releasing hazardous substances above both state and federal cleanup standards.

3.1.3 Forest Plan Standard and Guidelines (FP S&Gs)

Portions of the Colville National Forest LRMP (Forest Service, 1988), as amended by INFISH (Forest Service, 1995), are potentially applicable or relevant and appropriate for assessing Site remedial alternatives. The LRMP and INFISH include standards and guidelines that are potentially relevant and appropriate to actions at the Site, including activities within, or that affect Riparian Management Areas along the ephemeral tributary. These standards and guidelines include RF-2 through RF-5, which control the design, construction, and use of temporary and permanent roads and other modifications within Riparian Reserves; and MM-3, which controls solid waste and mine waste facilities within Riparian Reserves.

3.2 Proposed Cleanup Criteria

The proposed soil cleanup criteria are shown on Table 6. The cleanup criterion for each metal was developed using the following procedures:

- Priority was given first to state or federal ARARs protective of ecological receptors. The lower of the state or federal ARAR was initially selected as the cleanup criterion.
- The ARAR-based cleanup criterion was then compared to the 90th percentile of the Site background concentration and the Washington state (east region) natural background concentration. If the proposed cleanup criterion was exceeded by one or both of the background concentrations, the cleanup criterion was raised to the higher of the background concentrations exceeding the initial ARAR-based criterion.

Risk-based cleanup concentrations were not calculated for the waste rock.

- Depending on Site conditions and exposure scenarios, calculation of Site-specific risk-based cleanup concentrations may yield cleanup levels that are higher than applicable ARARs, which tend to be conservative.
- Potentially higher risk-based cleanup concentration may be advantageous when a removal action involves large volumes of material or requires technically challenging or costly remedial alternatives, because the higher risk-based cleanup concentrations may result in reduction of the volume of material that needs to be addressed as part of a removal action.
- Since the waste rock quantities at the Site are small, metals concentrations are relatively uniform across the waste rock piles, and the removal action alternatives are straightforward (as described in Section 5.0 below), calculation of risk-based concentrations was not expected to provide significant advantages over the ARARs used to develop the cleanup criteria.

4.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

The primary goal of a removal action is to protect human health and the environment by preventing or minimizing the potential release of a hazardous substance and reducing the potential for direct contact and transport of contaminants to the environment. Based on the physical hazards and ecological risks identified at the Kelly Camp Mine, the following non-time critical removal action objectives (RAO) were developed for the Site:

- Reduce wildlife exposure to **metals** in the waste rock piles and mine pool waters.
- Improve public safety by addressing physical hazards at the Site.
- Attain ARARs to the extent practical.

The following sections discuss the justification for a removal action at the Site, scope of the removal

action, and the proposed removal action schedule.

4.1 Removal Action Justification

40 CFR 300.415(b), lists several factors to be considered in determining whether a removal action is appropriate. The factors relevant at this Site, and the conditions establishing the presence of those factors, are summarized below:

- **High levels of hazardous substances, pollutants, or contaminants in soils, at or near the surface that may migrate:**
 - o The two waste rock piles on-Site have a total volume of approximately 580 bcy. Waste soil piles associated with other workings have a total volume of about 10 bcy.
 - o The waste rock piles contain high concentrations of several metals.
 - o The upper portion of the UWRP is steep and unvegetated. There is a potential for mobilization of waste rock during significant rain fall events.
- **Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants:**
 - o The streamlined ecological risk assessment indicated that the presence of a potentially unacceptable risk to ecological receptors from exposure to soil.
 - Metals concentrations in soil were initially compared to generic screening criteria developed for protection of terrestrial plants, soil biota, and wildlife (MTCA Table 749-3). Metals with concentrations exceeding screening criteria became CPECs.
 - CPECs in soil included twelve metals (arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, selenium, silver, and zinc) with risk ratios ranging from below one to 252.
 - The highest risk ratios were associated with copper (252), lead (9.0), and silver (14).
 - The calculated risk ratios indicate the presence of potentially unacceptable ecological risk from exposure to CPECs in soil, primarily due to copper, lead, and silver.
 - o Three CPECs, aluminum, barium, and copper, were present in mine water at concentrations that exceeded an ecological screening criterion.
 - Copper had a risk ratio greater than five.
 - Although potential ecological risk from ingestion of mine water may be low, a removal action that included installation of bat gates would eliminate exposure of large animals and humans to mine water.
- **Other situations or factors that may pose threats to public health or the environment:**
 - o Physical hazards at the Site that pose a potential risk to the public include an open shaft that could result in a fall of 10 to 20 feet and an open adit.

4.2 Scope of Removal Action

The scope of removal actions evaluated in this EE/CA focuses on eliminating ecological receptor direct contact with high concentrations of COIs in the waste rock and large animal exposure to mine waters, and mitigating physical hazards at the Site.

- The primary sources of contaminants at the Site contain high concentrations of metals and consist of the mine waste rock. Therefore, the scope of this removal action focuses on addressing the waste rock.

- Two removal action alternatives are considered that should significantly reduce the potential for direct contact with contaminants in the waste rock.
 - o Excavation of the LWRP, consolidation of the LWRP at the UWRP, then capping of the combined UWRP/LWRP material on-Site with clean soil. The small soil piles associated with other exploration cuts, trenches, and pits will be pushed back into their associated excavations. This alternative is referred to as the *on-Site alternative*.
 - o Excavation and off-Site disposal of the UWRP and LWRP material at a RCRA Subtitle D landfill. As with the on-Site alternative, the small soil piles associated with other exploration cuts, trenches, and pits will be pushed back into their associated excavations. This alternative is referred to as the *off-Site alternative*.

Confirmation sampling will be required to evaluate the removal action effectiveness and compliance with the ARARs.

- For the on-Site alternative, confirmation sampling will be required at the LWRP excavation area to ensure that the underlying soils exposed by LWRP excavation meet the proposed Site cleanup criteria.
- For the off-Site alternative, confirmation sampling will be required at the LWRP and UWRP excavation area to ensure that the underlying soils exposed by LWRP and UWRP excavation meet the proposed Site cleanup criteria.
- For both alternatives, the number and type of samples, analytical methods, and MDLs should be determined in coordination with the applicable Washington state agencies. Contingency measures should be identified in the event the analytical results indicate the Site cleanup criteria are not being met in the underlying soils exposed by waste rock removal.

Post-removal action operation and maintenance (O&M) activities will be required to monitor the removal action effectiveness and compliance with the ARARs.

- Visual, post-construction monitoring of the cap will be necessary to document that revegetation of the cap is occurring to ensure that the cap remains stable and re-exposure of waste rock by erosion does not occur.
- Visual, post-construction monitoring of the cap, aggregate borrow areas, and any other areas disturbed by the removal action will be necessary to ensure infestations of noxious or invasive weeds are identified and eradicated.

4.3 Removal Action Schedule

The removal action is tentatively scheduled for 2010; however, the date is dependent on funding availability and may be subject to change by the Forest Service.

5.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section describes the selection of a removal action using a three-step process:

- 1) Identify potential removal action options and alternatives applicable to the Site and screen to eliminate ineffective or unfeasible alternatives;
- 2) Analyze selected removal action alternatives based on effectiveness, implementability, and cost; and
- 3) Identify existing data gaps that are relevant to the selected alternatives.

5.1 Identification and Screening of Removal Action Options and Alternatives

Removal action technologies applicable to the Site were identified based on previous experience at

similar mine sites. The technologies, described in Table 7, were screened to eliminate inappropriate, ineffective, infeasible or cost prohibitive methods. In addition, technologies with unproven or uncertain performance were eliminated if they had relatively high implementation costs and/or would likely require implementation with other costly mitigation components. Technologies with uncertain or unproven performance were retained if they represented potentially cost effective mitigation and the performance can be investigated through pilot or bench scale testing. For this EE/CA, a potentially cost effective technology is one that could provide protection comparable to other standard methods utilized in mine reclamation, at a cost similar to or less than the costs of those methods. All components not screened out were retained as potential technologies that could be implemented at the Site.

The technologies were assessed relative to others in the same sub-category based on effectiveness, implementability, and cost. This allowed each technology to be assigned a relative ranking of high, medium, or low for each evaluation criterion. Table 7 summarizes the results of the removal action technology screening process, including the technologies retained for incorporation into removal action alternatives.

Based on results of the removal action technology screening process, three removal action alternatives were selected for detailed analysis. The alternatives include:

- **ALTERNATIVE 1 – NO ACTION**
- **ALTERNATIVE 2 – CONSOLIDATION AND ON-SITE CAPPING**
- **ALTERNATIVE 3 – EXCAVATION AND OFF-SITE DISPOSAL**

Each alternative is discussed below.

5.2 Removal Action Elements Common to all Action Alternatives

Certain work elements would be employed and implemented regardless of the action alternative (Alternatives 2 and 3) selected. These elements include:

- Clearing/grubbing vegetation at the LWRP and UWRP. Whether the waste rock is consolidated and capped on-Site, or excavated and disposed off-Site, some vegetation removal will be required at both waste rock piles. The vegetation will be stockpiled on-Site and returned to the excavation areas during Site restoration.
- Excavation of the LWRP. This activity is an element of both the on-Site and off-Site alternatives, and will include the following tasks:
 - o Removal and off-Site disposal of wood debris associated with the former structure.
 - o Confirmation sampling of the LWRP excavation.
- Placement of the small soil piles associated with other exploration cuts, trenches, and pits into their associated excavations. A small bulldozer or track-mounted excavator will be used to place the soil back into the excavations
- Installation of bat gates at the lower adit and at two adits at the main working/stope.
- Backfilling two shafts at the main working/stope with waste rock. For the on-Site alternative, LWRP material will be used to backfill the shafts. For the off-Site alternative, UWRP material will be used.
- Best management practices (BMP) may be implemented, as needed, during the on-Site work to contain run-off, minimize erosion, and minimize the potential for spread of noxious weeds.
 - o The removal actions will likely occur during the dry season. This combined with the fact that there are no surface water features nearby makes it unlikely that BMPs will be necessary for

- run-off or erosion control. Potential erosion control BMPs may include silt fencing, straw bales, temporary surface water diversions, and dust suppression.
- o BMPs for minimizing the spread of noxious weeds may include wheel washing of trucks driving to/from the Site and aggregate borrow areas.
- Confirmation sampling of the LWRP footprint after excavation of the LWRP.
- Restoration and revegetation of the cap, borrow areas, and any other areas disturbed by the removal action.
- O&M monitoring of the cap and other areas disturbed by the removal action.

5.3 Description of Alternatives

The three alternatives are described below.

5.3.1 Alternative 1 – No Action

This alternative consists of no further action and leaving the Site as is:

- The UWRP and LWRP would remain at their current locations.
- The exploration cuts, trenches, and pits would not be backfilled with their associated waste soil piles.
- Physical hazards associated with adits and shafts would not be addressed.

5.3.2 Alternative 2 – Consolidation and On-Site Capping

This alternative involves the consolidation of the LWRP at the UWRP and capping of both on-Site. The basic elements of this alternative are depicted on Figure 6. This alternative includes the following elements:

- Mobilization of equipment to the Site, which may include the following:
 - o Small and large track-mounted excavators.
 - o Off-road 25-ton haul trucks.
 - o Front-end loader.
 - o Small dozer.
 - o Water truck.
 - o Chain saw and hand tools.
 - o Pressure washer.
 - o Sanitary and decontamination facilities.
- Excavation and consolidation of the LWRP at the UWRP.
 - o Remove wood debris from the LWRP and dispose off-Site.
 - o Clear vegetation from the LWRP and UWRP. Set aside for later use during Site restoration.
 - o Excavate the LWRP down to the underlying native soil or bedrock (whichever is encountered). The LWRP estimated volume is 156 bcy.
 - o Load the LWRP material into 25-ton articulating haul trucks and transport the material to the UWRP.
 - o Place the LWRP material onto and within the footprint of the UWRP. Use the LWRP

material to fill low points in the UWRP to achieve a more even topography of the UWRP. As necessary, grade the combined LWRP/UWRP to stabilize slopes and make the surface of the pile more uniform.

- Backfilling the two eastern-most shafts at the upper working/stope.
 - o Use large rock from the blast rock pile to initially plug the shafts, and to minimize the amount of material needed to backfill the shafts.
 - o Use material from the excavation of the LWRP to backfill the shafts.
 - o Complete the backfilling with an approximately 1-foot-thick layer of aggregate from the Fill #1 and/or Fill #2 source areas.
- Confirmation sampling of the LWRP excavation footprint.
 - o Following excavation of the LWRP, soil samples will be collected from the excavation footprint and analyzed at an approved laboratory for total metals.
 - o Analytical results will be compared to the proposed cleanup criteria.
 - o The analytical results will provide the basis for determining whether additional excavation is required to meet the cleanup criteria.
 - o As described in Section 5.5, it is assumed that exceedances of the screening criteria will necessitate overexcavation, resulting in a 20 percent increase in excavated waste rock volume.
- Capping the combined LWRP/UWRP with clean aggregate obtained from the Fill #1 and/or Fill #2 source areas describe in Section 2.5.3 and shown on Figure 5.
 - o Soil analytical data for the Fill #1 and Fill #2 source areas demonstrate that metals concentrations in soil from these sources areas are below the proposed soil cleanup criteria, as shown on Table 8.
 - o Excavate aggregate material from the source area.
 - o Screen the aggregate material at the source site to remove rocks and other materials greater than 6 inches in size.
 - o Transport about 900 loose cubic yards (lcy) of the screened aggregate from the source area using the articulating haul trucks.
 - o Spread the aggregate evenly over the UWRP footprint (about 0.34 acre) to a minimum thickness of 1.5 feet.
 - o Compact the aggregate with a vibratory roller to produce a compacted cap with a minimum thickness of 1 foot. Compaction will be performed to the standard of “no visible deflection.”
- Backfilling other exploration cuts, trenches.
 - o Approximately seven miscellaneous excavations were identified during the SI, all located west of the blast rock pile.
 - o Use a small track-mounted excavator or loader to push small soil piles back into the small excavation features.
- Install bat gates at the main and west entrances to the upper working/stope and at the lower adit entrance. A conceptual bat gate design is shown on Figure 7.
- Restoration and revegetation of the LWRP and UWRP.

- o Purchase about 450 lcy of EKO Compost and transport to the Site.
- o Cover the LWRP excavation area (about 0.07 acre) with EKO compost to a minimum 6-inch thickness.
- o Cover the consolidated LWRP/UWRP area EKO compost to a minimum 6-inch thickness.
- o Seed the surface of the EKO compost at the LWRP excavation area and the consolidated LWRP/UWRP area with a Forest Service approved seed mix.
- o Return cleared vegetation to both areas by spreading the vegetation evenly over the areas.

5.3.3 Alternative 3 – Excavation and Off-Site Disposal

This alternative involves the excavation of the LWRP and UWRP and disposal of the material at an off-Site RCRA Subtitle D landfill. The basic elements of this alternative are depicted on Figure 8. This alternative includes the following elements:

- Mobilization of equipment to the Site, which may include the following:
 - o Small and large track-mounted excavators.
 - o Off-road 25-ton haul trucks.
 - o Front-end loader.
 - o Small dozer.
 - o Highway legal 30-ton dump trucks.
 - o Water truck.
 - o Chain saw and hand tools.
 - o Pressure washer.
 - o Sanitary and decontamination facilities.
- Excavation of the LWRP and UWRP.
 - o Remove wood debris from the LWRP and dispose off-Site.
 - o Clear vegetation from the LWRP and UWRP. Set aside for later use during Site restoration.
 - o Excavate the LWRP down to the underlying native soil or bedrock (whichever is encountered). The LWRP estimated volume is 156 bcy.
 - o Excavate the UWRP down to the underlying native soil or bedrock (whichever is encountered). The UWRP estimated volume is 427 bcy.
 - o Stage the excavated material at a staging area near the entrance to the Site access road.
- Backfilling the two eastern-most shafts at the upper working/stope.
 - o Use material from the excavation of the UWRP to backfill the shafts. Carefully place the material into the shaft to maximize filling of the stope with waste rock and to minimize the amount of waste rock that will require off-Site disposal. As described in Section 5.5, it is estimated that up to 40 bcy of waste rock can be placed in the shafts, but this volume could vary.
 - o Complete the backfilling with an approximately 1-foot-thick layer of soil obtained from on-Site.
- Confirmation sampling of the LWRP and UWRP excavation footprints.

- o Following excavation of the LWRP and UWRP, soil samples will be collected from the excavation footprints and analyzed at an approved laboratory for total metals.
- o Analytical results will be compared to the proposed cleanup criteria.
- o The analytical results will provide the basis for determining whether additional excavation is required to meet the cleanup criteria.
- o As described in Section 5.5, it is assumed that exceedances of the screening criteria will necessitate overexcavation, resulting in a 20 percent increase in excavated waste rock volume.
- Transportation and off-Site disposal of waste rock.
 - o Load the LWRP and UWRP material into 25-ton haul trucks (truck and pup).
 - o All truck loads shall be covered to contain the waste rock in the trucks during transportation.
 - o Transport the material to either the Graham Road Subtitle D landfill in Spokane, or the Wenatchee Subtitle D landfill in East Wenatchee.
 - Both landfills are approximately equidistant from the Site.
 - The Graham Road landfill accepts wood waste.
 - Disposal at Graham Road would allow the haul trucks to back-haul EKO compost from the Spokane.
 - The Graham Road landfill is the preferred landfill for waste rock disposal.
- Backfilling other exploration cuts, trenches, as described above for the on-Site alternative.
- Install bat gates as described above for the on-Site alternative.
- Restoration and revegetation of the LWRP and UWRP excavation areas using the same procedures as described above for the on-Site alternative.

5.4 Analysis of Selected Removal Action Alternatives

The removal action alternatives were evaluated based on the following criteria:

- Effectiveness
- Implementability
- Relative cost

Effectiveness is defined as the ability of an alternative (relative to other options in the same technology sub-category) to:

- Protect public health and the community, protect workers during implementation, and protect the environment – addresses whether or not the remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls; and
- Comply with ARARs – addresses whether or not a remedy will meet all ARARs or other federal and state environmental statutes and/or provide grounds for invoking a waiver.

Implementability encompasses the technical and administrative feasibility of implementing a removal action and the availability of resources needed to implement the removal action. It also takes into account legal considerations. Factors of particular consideration include removal action and operational feasibility; availability of equipment, personnel, and treatment capacity; community acceptance; and the

ability to obtain necessary permits for off-Site actions.

- Technical feasibility – refers to construction and operational considerations, the demonstrated performance and useful life, adaptability to Site-specific environmental conditions, whether it contributes to remedial performance, and whether it can be implemented within 1 year².
- Administrative feasibility – refers to the permits required, easements or right-of-ways required, impacts on adjoining properties, the ability to implement institutional controls, and the likelihood of obtaining an exemption from statutory limits, if needed.
- Availability – includes the availability of equipment, personnel and services, outside laboratory testing services (if needed), and off-Site disposal capacity (if needed).

The relative cost of each alternative was evaluated based on professional experience, engineering judgment, and standard cost estimating tools. Primary cost considerations include:

- Capital costs.
- Engineering and design costs.
- O&M costs.

The estimated costs for each task are provided in Appendix C and summarized in Table 9. Costs are based on experience at similar sites, on published data and reports, and on inquiries to possible vendors. Many removal action unit costs were obtained from R.S. Means (2008), and include overhead and profit. Estimated costs relied on several assumptions regarding Site conditions and are based on conceptual design only. The estimated costs are intended for alternative comparison only and are not suitable for construction bidding purposes.

Assumptions made in preparing the cost estimate include:

- The action alternatives can be completed in one field season using standard removal action equipment.
- A sufficient amount of 6-inch minus aggregate material for on-Site capping will be readily available at the Fill #1 and/or Fill #2 sites, and will not require extensive screening activities.
- URS has not conducted a botanical survey of the Fill #1 and Fill #2 sites and therefore it is not known whether non-native or invasive species may be present at the fill sites. URS assumes the Forest Service will approve use of the Fill #1 and Fill #2 source materials as is.
- Restoration of portions of the Fill #1 and/or Fill #2 sites affected by excavation of aggregate will be limited to grading and leveling the work areas.
- Significant cost savings may be realized by substituting a non-certified compost from a local source for the EKO compost that would be delivered to the Site from the Spokane area.
- The Forest Service will allow operation of the 25-ton articulating haul trucks on Forest Service roads.
- Waste rock is assumed to be non-hazardous based on existing TCLP data.
- For the off-Site alternative, it is assumed that up to 40 bcy of material from the UWRP can be placed during backfilling of the two eastern-most shafts at the upper working/stope.
- Except during bat gate installation, personnel and equipment shall not enter the adits, shafts, or

² The ability to be implemented in 1 year is a specific criterion to be used in the alternative comparative analysis as outlined in EPA's "Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA" (1993). There is a 1-year statutory limit for fund-financed removal actions.

stope during the removal action.

- Existing data will be sufficient for characterization and profiling wastes for landfill disposal.
- A temporary staging area can be established on-Site.
- Significant improvement to the on-Site access road will not be necessary for the purpose of loading or offloading equipment and materials.
- Improvements to Forest Service roads will not be necessary.
- The Forest Service and State Historic Preservation Office (SHPO) will approve removal of wood debris associated with the former structure at the LWRP.
- All trees and brush cleared during the removal action will be stockpiled and placed over the work areas during to minimize erosion, or burned on-Site.
- Post-removal action O&M monitoring of the Site will be required to monitor the removal action effectiveness and compliance with the ARARs.
 - o Monitoring of the cap will be necessary to document that the cap remains stable and re-exposure of waste rock by erosion does not occur. URS assumes monitoring will occur once a year during the winter for five years.
 - o Non-native or invasive species monitoring and management at the Site is included as part of post-removal action O&M activities. URS assumes monitoring will occur once a year during the late spring for five years.
- The estimated fees for removal action oversight were based on the anticipated duration of the removal action and ranged from \$15,000 to \$18,000.
- The total estimated removal action costs include a 20 percent contingency.
- Present value corrections were not calculated because of the short duration of the removal action and monitoring.

5.5 Identification of Data Gaps

The following two data gaps were identified during preparation of this EE/CA:

1. Lack of analytical data for metals in soils underlying the waste rock piles.
 - It is not known weather metals concentrations in native soil below the LWRP and UWRP are below the proposed cleanup criteria.
 - The possibility exists that the concentrations could exceed the cleanup criteria owing to 1) background concentrations in the soil and/or 2) leaching of metals from the waste rock into the underlying soil.
 - If metals concentrations in underlying native soils exceed the cleanup criteria, overexcavation of native soils may be necessary.
2. Shape, orientation, and position of two eastern-most shafts at the upper working/stope.
 - For the off-Site alternative, the amount of UWRP material that can be placed during backfilling of the two shafts will depend on the shape, orientation, and position of the shafts relative to the stope interior.
 - Based on visual observation of the shafts during the SI, it is estimated that up to 40 bcy of waste rock can be placed in the shafts, but this volume could vary. The cost for the off-Site alternative decreases as the amount of material placed in the shaft increases because it reduces the volume of

material requiring off-Site disposal.

The costs associated with the data gaps are included in the cost estimate.

- Data gap #1:
 - o For Alternative 2, the cost to excavate and consolidate the LWRP assumes a 20 percent increase in excavated soil volume associated with overexcavation of underlying native soils.
 - o For Alternative 3, the cost to excavate, transport, and dispose of the LWRP and UWRP also assumes a 20 percent increase in excavated soil volume associated with overexcavation of underlying native soils.
- Data gap #2:
 - o For Alternative 3, the cost assumes up to 40 bcy of waste rock can be placed in the shafts.

Broad assumptions regarding material quantities and Site conditions were used to address the data gaps in the development of conceptual designs presented in this EE/CA. However, additional data that is critical to the removal action should be collected before preparing the final design. This would include laboratory analysis of native soil samples collected from beneath the waste rock piles.

6.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

The removal action alternatives were compared based on the following criteria:

- Effectiveness.
 - o Protective of human health and the environment.
 - o Complies with ARARs, especially key ARARs identified for the Site.
 - o Achieves RAOs.
- Implementability
 - o Technical Feasibility
 - o Administrative Feasibility
 - o Availability of Resources
- Cost

The comparative analysis of removal action alternatives is described in Table 10 and summarized below by criteria. State and community acceptance will be determined during the public comment period. Physical hazards were assumed to be equally addressed in all of the action alternatives as discussed in Section 5.2.

6.1 Effectiveness

- Alternative 1 – No Action is the least effective.
 - o The waste rock would continue to pose a risk to ecological receptors. Although the potential for risk due to human exposure to waste rock is low, the potential for the risk would continue indefinitely.
 - o Physical hazards would continue to pose a threat to humans.
- Alternative 2 – Consolidation and on-Site capping provides protection to ecological receptors, and the potential for human exposure to waste rock would be further reduced.
 - o Most soil RAOs would be achieved under this alternative by capping the waste rock with

- clean aggregate. This alternative would reduce but not eliminate wildlife exposure to metals in waste rock because waste rock with metals concentrations exceeding the proposed cleanup criteria would remain on-Site.
- o Physical hazards to humans would be addressed.
 - o Chemical-specific ARARs for soil (Table 6) would generally be attained:
 - Soils used for capping would reduce surface soil concentrations to background levels, or to the lowest MTCA criteria (Table 6), whichever is greater.
 - In accordance with WAC 173-340-703, chromium meets the definition of an indicator substance for the excavation of the LWRP. Chromium and copper meet the definition of an indicator substance for the capping of the combined LWRP and UWRP material.
 - The alternative would not meet the MTCA terrestrial ecological substantive cap thickness of 6 feet but would protect surface- and many sub-surface- dwelling ecological receptors from direct exposure to waste rock.
 - There would still be a potential for burrowing organisms to come in contact with waste rock. However, because the waste rock would be consolidated and capped, the potential is significantly reduced compared to the existing conditions. The potential for burrowing organisms to contact that buried waste rock would be low because of the small area of the waste rock. Capping would eliminate exposure of surface dwelling organisms to waste rock contaminants and would significantly reduce the potential for contaminants to migrate to the surface.
 - o Compliance with most solids disposal ARARs – Key action-specific ARARs would generally be attained. Contaminated wastes would be isolated from the environment on-Site.
 - o Not all state landfill standards (WAC 173-350-400) would be met by this alternative.
 - The cap would not be constructed with a liner system. However, the ABA, TCLP, and SPLP results suggest that groundwater is unlikely to be impaired by leachate from waste rock and blast rock piles. Therefore a liner is not necessary.
 - The cap would not be constructed with a leachate collection and control system for the same reason it would not be constructed with a liner.
 - The cap would not be constructed with a minimum two foot thick anti-erosion layer. The final cap would have a minimum thickness of one foot and would be covered with compost and seeded. This design, coupled with the fact that the site does not exhibit characteristics of excessive erosion, will provide sufficient protection against erosion.
 - The cap would not be constructed with a geomembrane. The site characteristics (slope, stability, etc.) do not necessitate a geomembrane for the purpose of meeting the RAOs.
 - o Compliance with FP S&G ARARs – Key location-specific ARARs would be attained. There would be no disturbance to Riparian Reserves.
 - o The alternative is effective and provides long-term permanence (see Table 10).
 - o No reduction in toxicity or volume through treatment, but moderate to high reduction in exposure through consolidation and capping.
 - o Eliminates risk to the community from long-distance transport of waste rock.
 - o Minimal potential risk to human health and the environment during on-Site consolidation and capping.

- Alternative 3 – Excavation and off-Site disposal provides the most protection to ecological and human receptors by removing the waste rock from the Site and disposing of it in a controlled facility.
 - o The soil RAOs would be achieved under this alternative by excavating the mine waste and disposing of them off-Site at a RCRA Subtitle D landfill.
 - o Physical hazards to humans would be addressed to the same degree as Alternative 2.
 - o Chemical-specific ARARs for soil (Table 6) would be attained:
 - Excavation of waste rock would reduce surface soil metals concentrations to background levels, or to the lowest MTCA criteria (Table 6), whichever is greater.
 - In accordance with WAC 173-340-703, chromium and copper meet the definition of an indicator substance for the excavation of the LWRP and UWRP material.
 - o Compliance with Solids Disposal ARARs – Key action-specific ARARs would be attained. Contaminated wastes would be isolated from the environment in an off-Site permitted waste facility.
 - o Compliance with FP S&G ARARs – Key location-specific ARARs would be attained. There would be no disturbance to Riparian Reserves.
 - o The alternative is highly effective and provides long-term permanence (Table 10).
 - o Minimal potential risk to human health and the environment during off-Site transportation of waste rock.
 - o No reduction in toxicity or volume through treatment, but high reduction in exposure through containment at a RCRA Subtitle D landfill.

6.2 Implementability

- Alternative 1 – No Action is most technically feasible and easiest to implement.
- Alternative 2 – Consolidation and on-Site capping is moderately to highly implementable.
 - o The availability of service and materials is high.
 - o The alternative is implementable using standard construction equipment and methods.
 - o Capping soils would be obtained from a nearby, off-Site aggregate borrow area.
- Alternative 3 – Excavation and off-Site disposal would be moderately to highly implementable.
 - o The availability of service and materials is high.
 - o The alternative is implementable using standard construction equipment and methods.
 - o The alternative would require a relatively long distance for transport of the waste rock to the off-Site disposal facility.

6.3 Cost

- Alternative 1 – No Action is the least expensive alternative.
- Alternative 2 – Consolidation and on-Site capping is moderately expensive (\$158,000).
- Alternative 3 – Excavation and off-Site disposal is the most expensive alternative (\$274,000).

7.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

Based on the elements of the alternatives described in Section 5.3, and the comparative analysis of the alternatives in Section 6.0 and Table 10, the recommended alternative is Alternative 2.

The recommended alternative would consolidate the 156 bcy LWRP at the UWRP, and then cap the combined LWRP/UWRP with clean soil. Other exploration cuts, trenches, and pits would be backfilled, and access to the adits and stope would be eliminated to reduce physical hazards. The removal action would achieve RAOs and attain ARARs to the extent practical by eliminating direct contact of surface-dwelling ecological receptors to waste rock. There would still be a potential for burrowing organisms to come in contact with waste rock and potential migration of contaminants to the surface. However, because of the very small area involved and because the waste rock would be consolidated and capped, the potential is significantly reduced compared to the existing conditions.

The recommended alternative will satisfy the eight factors in 40 CFR 300.415(b) as described below.

Factor	Site Condition	Satisfied?
(1) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants, or contaminants.	The potential for human and ecological exposure to waste rock will be significantly reduced following consolidation and capping of the waste rock.	Yes
(2) Actual or potential contamination of drinking water supplies or sensitive ecosystems.	There are no drinking wells or sensitive ecosystems on or near the Site. The ABA, TCLP, and SPLP results suggest that groundwater and surface water are unlikely to be impaired by leachate from waste rock. The removal action does not need to address this factor.	Not Applicable
(3) Hazardous substances, pollutants, or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release.	There are no hazardous substances, pollutants, or contaminants in drums, barrels, tanks, or other bulk storage containers. The removal action does not need to address this factor.	Not Applicable
(4) High levels of hazardous substances, pollutants, or contaminants in soils largely at, or near, the surface that may migrate.	There does not appear to be a potential for migration of hazardous substances from the Site. However, the removal action will further minimize this potential.	Yes
(5) Weather conditions that may cause hazardous substances, pollutants, or contaminants to migrate or be released.	There does not appear to be a potential for weather conditions to cause hazardous substances, pollutants, or contaminants to migrate or be released. However, the removal action will further minimize this potential.	Yes
(6) Threat of fire or explosion.	No flammable materials on-Site.	Not Applicable
(7) The availability of other appropriate federal or state response mechanisms to respond to the release.	The Site is on Forest Service land and is being addressed by the Forest Service.	Yes
(8) Other situations or factors that may pose threats.	Physical hazards will be mitigated.	Yes

The total estimated removal action cost is **\$158,000**.

The proposed removal action designs presented in this EE/CA are conceptual only and not intended for removal action. All material quantities are estimates only and should be verified for final design.

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12/22/09

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12/22/09

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Technical Reviewer

Date

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TABLES

Table 1. Mine Water Analytical Data Summary and Screening
Kelly Camp Mine EE/CA

Sample ID	Sample Date	Metals Analysis (mg/L)																																			
		Aluminum		Antimony		Arsenic		Arsenic +3		Arsenic +5		Barium		Beryllium		Bismuth		Boron		Cadmium		Calcium		Chromium		Chromium +6		Cobalt		Copper		Gallium		Iron		Lanthanum	
		Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved		
MW-1	7/26/2007	0.12	0.08 U	0.020 U	0.020 U	0.0030 U	0.0030 U	0.0030 U	0.0030 U	0.0030 U	0.0030 U	0.0056	0.0043	0.0020 U	0.0020 U	0.06 U	0.06 U	0.040 U	0.040 U	0.0020 U	0.0020 U	26.5	26	0.006 U	0.006 U	0.01 U	0.01 U	0.006 U	0.006 U	0.211	0.099	0.020 U	0.020 U	0.34	0.34 U	0.0079	0.0074
MW-2	7/26/2007	0.08 U	0.08 U	0.020 U	0.020 U	0.0030 U	0.0030 U	0.0030 U	0.0030 U	0.0030 U	0.0030 U	0.0049	0.0044	0.0020 U	0.0020 U	0.06 U	0.06 U	0.040 U	0.040 U	0.0020 U	0.0020 U	27.9	27.4	0.006 U	0.006 U	0.01 U	0.01 U	0.006 U	0.006 U	0.131	0.082	0.020 U	0.020 U	0.23	0.06 U	0.0081	0.0078
Maximum Concentration		0.12	0.08 U	0.020 U	0.020 U	0.0030 U	0.0030 U	0.0030 U	0.0030 U	0.003 U	0.003 U	0.0056	0.0044	0.0020 U	0.0020 U	0.06 U	0.06 U	0.040 U	0.040 U	0.0020 U	0.0020 U	27.9	27.4	0.006 U	0.006 U	0.010 U	0.010 U	0.006 U	0.006 U	0.211	0.099	0.020 U	0.020 U	0.34	0.34 U	0.0081	0.0078
Human Health Water Screening Criteria																																					
WDOE Method A Cleanup Levels for Groundwater ¹		--	--	--	--	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--	0.005	--	--	--	0.05	--	--	--	--	--	--	--	--	--	--	--	--	--
WDOE Method B Cleanup Levels for Groundwater ¹		--	--	0.0064	--	4.80E-03	--	--	--	--	--	3.2	--	0.032	--	--	--	3.2	--	0.008	--	--	--	24(Cr ³⁺)	--	0.048	--	--	--	0.592	--	--	--	--	--	--	--
WDOH MCLs ²		--	--	0.006	--	0.010	--	--	--	--	--	2	--	0.004	--	--	--	--	--	0.005	--	--	--	0.1	--	--	--	--	--	1.3 ^a	--	--	--	0.3 ^b	--	--	--
EPA Drinking Water MCLs ³		0.05 to 0.2 ^b	--	0.006	--	0.010	--	--	--	--	--	2	--	0.004	--	--	--	--	--	0.005	--	--	--	0.1	--	--	--	--	--	1 ^b	--	--	--	0.3 ^b	--	--	--
Ecological Water Screening Criteria																																					
WDOE Aquatic Life (Table 240(3)) ⁴		--	--	--	--	--	0.19	--	--	--	--	--	--	--	--	--	--	--	--	--	0.000897	--	--	0.15265	--	--	0.01	--	--	--	0.0097	--	--	--	--	--	--
ORNL PRGs for Ecological Endpoints ⁵		0.087	--	0.03	--	--	--	0.19	--	0.0031	--	0.004	--	0.00066	--	--	--	0.0016	--	0.0011	--	--	--	0.21 (Cr III)	--	0.011	--	0.023	--	0.012	--	--	--	1.0	--	--	--

Notes:

Underlined criterion is not exceeded but detection limits are higher than the criteria.

Bolded screening criterion is exceeded

Hardness = 82.89 CaCO₃/L. Hardness was calculated as hardness = 2.497 (Ca, mg/L) + 4.118 (Mg, mg/L). The average of dissolved Ca and Mg sample concentrations were used.

^a = action level

^b = secondary criteria

mg/L = milligrams per liter water

U = The analyte was analyzed for but not detected at or above the reported method reporting limit (MRL).

-- = no screening criterion was available for this analyte

Sources:

¹ WDOE. 2005. Model Toxics Control Act Chapter 70.05D RCW and Cleanup Regulation Chapter 173-340 WAC. Washington State Department of Ecology, Toxics Cleanup Program. Revised October 2005. Publication No. 94-06

² WAC 2004. Washington Administrative Code 246-290-310. Maximum Contaminant Levels (MCLs)

³ EPA Drinking Water MCLs. EPA. 2006 National Recommended Water Quality Criteria. Office of Water, Office of Science and Technology.

⁴ WAC, 2006. Washington Administrative Code 173-201A-240. Water Quality Standards for Surface Waters of the State of Washington.

⁵Efroymson, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones. 1997. Preliminary Remediation Goals for Ecological Endpoints. Oak Ridge National Laboratory, Oak Ridge, TN. August. ES/ER/TM-162/R2

Table 1. Mine Water Analytical Data Summary and Screening
Kelly Camp Mine EE/CA

Sample ID	Sample Date	Metals Analysis (mg/L)																																			
		Lead		Lithium		Magnesium		Manganese		Mercury		Molybdenum		Nickel		Phosphorus		Scandium		Selenium		Silver		Sodium		Strontium		Thallium		Tin		Titanium		Vanadium		Zinc	
		Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved		
MW-1	7/26/2007	0.0075 U	0.0075 U	0.02 U	0.02 U	3.92	3.83	0.0723	0.0607	0.00020 U	0.00020 U	0.008 U	0.008 U	0.010 U	0.010 U	0.05 U	0.05 U	0.0020 U	0.0020 U	0.04 U	0.04 U	0.005 U	0.005 U	2.89	2.84	0.103	0.1	0.015 U	0.015 U	0.050 U	0.050 U	0.006	0.005 U	0.0050 U	0.0050 U	0.036	0.03
MW-2	7/26/2007	0.0075 U	0.0075 U	0.02 U	0.02 U	4.14	4.05	0.117	0.115	0.00020 U	0.00020 U	0.008	0.008	0.010 U	0.010 U	0.05 U	0.05 U	0.0020 U	0.0020 U	0.04 U	0.04 U	0.005 U	0.005 U	2.98	2.95	0.11	0.109	0.015 U	0.015 U	0.050 U	0.050 U	0.005 U	0.005 U	0.0050 U	0.0050 U	0.032	0.029
Maximum Concentration		0.0075 U	0.0075 U	0.02 U	0.02 U	4.14	4.05	0.117	0.115	0.00020 U	0.00020 U	0.008	0.008	0.010 U	0.010 U	0.05 U	0.05 U	0.0020 U	0.0020 U	0.04 U	0.04 U	0.005 U	0.005 U	2.98	2.95	0.11	0.109	0.015 U	0.015 U	0.050 U	0.050 U	0.005 U	0.005 U	0.0050 U	0.0050 U	0.036	0.03
Human Health Water Screening Criteria																																					
WDOE Method A Cleanup Levels for Groundwater ¹		0.015	--	--	--	--	--	--	--	0.002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WDOE Method B Cleanup Levels for Groundwater ¹		--	--	--	--	--	--	2.2	--	0.0048	--	0.080	--	0.32	--	1.6E-04	--	--	--	0.08	--	0.08	--	--	--	9.6	--	0.0011	--	9.6	--	--	--	0.11	--	4.8	--
WDOH MCLs ²		0.015 ^a	--	--	--	--	--	0.05 ^b	--	0.002	--	--	--	0.1	--	--	--	--	--	0.05	--	0.1 ^b	--	--	--	--	--	0.002	--	--	--	--	--	--	--	5 ^b	--
EPA Drinking Water MCLs ³		0.015	--	--	--	--	--	0.05 ^b	--	0.002	--	--	--	--	--	--	--	--	--	0.05	--	0.1 ^b	--	--	--	--	--	0.002	--	--	--	--	--	--	--	5 ^b	--
Ecological Water Screening Criteria																																					
WDOE Aquatic Life (Table 240(3)) ⁴		--	0.00205	--	--	--	--	--	--	0.000012	--	--	--	--	0.112099	--	--	--	--	0.005	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.089145	
ORNL PRGs for Ecological Endpoints ⁵		0.0032	--	0.014	--	--	--	0.12	--	0.0013	--	0.37	--	0.16	--	--	--	--	--	0.00039	--	0.00036	--	--	--	1.5	--	0.009	--	0.073	--	--	--	0.02	--	0.11	--

Notes:

Underlined criterion is not exceeded but detection limits are higher than the criteria.

Bolded screening criterion is exceeded by 95% UCL

Hardness = 82.89 CaCO₃/L. Hardness was calculated as hardness = 2.497 (Ca, mg/L) + 4.118 (Mg, mg/L). The average of dissolved Ca and Mg sample concentrations were used.

^a = action level

^b = secondary criteria

mg/L = milligrams per liter water

U = The analyte was analyzed for but not detected at or above the reported method reporting limit (MRL).

-- = no screening criterion was available for this analyte

Sources:

¹ WDOE. 2005. Model Toxics Control Act Chapter 70.05D RCW and Cleanup Regulation Chapter 173-340 WAC. Washington State Department of Ecology, Toxics Cleanup Program. Revised October 2005. Publication No. 94-06

² WAC 2004. Washington Administrative Code 246-290-310. Maximum Contaminant Levels (MCLs)

³ EPA Drinking Water MCLs. EPA. 2006 National Recommended Water Quality Criteria. Office of Water, Office of Science and Technology.

⁴ WAC, 2006. Washington Administrative Code 173-201A-240. Waster Quality Standards for Surface Waters of the State of Washington.

⁵ Efroymsen, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones. 1997. Preliminary Remediation Goals for Ecological Endpoints. Oak Ridge National Laboratory, Oak Ridge, TN. August. ES/ER/TM-162/R2

Table 2. Mine Site and Background Soil Data Summary (mg/kg)
Kelly Camp Mine EE/CA

Sample ID	Sample Date	Total Metals (mg/kg dry weight)													
		Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Zinc
Background Soil															
SB-1	7/27/2007	2.5 U	194	--	0.69	19.3	4.63	10.7	7.19	500	0.033 U	--	4 U	0.50 U	51
SB-2	7/27/2007	2.5 U	179	--	0.8	22	5	11.3	8.41	552	0.033 U	--	4 U	0.50 U	43.7
SB-3	7/27/2007	2.5 U	174	--	0.71	16.8	4.49	11.1	7.17	538	0.033 U	--	4 U	0.50 U	41.4
SB-4	7/27/2007	2.5 U	177	--	0.75	19.3	4.91	11.6	7.86	573	0.033 U	--	4 U	0.50 U	49.4
SB-5	7/27/2007	2.5 U	180	--	0.94	26.4	5.91	80.9	9.27	518	0.033 U	--	4 U	0.50 U	54.3
SB-6	7/27/2007	3.5	205	--	1.09	29.9	6.83	17.5	8.85	630	0.033 U	--	4 U	0.50 U	59
SB-7	7/27/2007	2.5 U	181	--	0.72	19	5.01	11.8	7.27	584	0.033 U	--	4 U	0.50 U	49.5
SB-8	7/27/2007	2.5 U	226	--	0.83	17.3	4.73	12.6	7.96	686	0.033 U	--	4 U	0.50 U	54.2
SB-9	7/27/2007	2.5 U	253	--	0.86	17.3	5.19	12.1	6.92	768	0.033 U	--	4 U	0.50 U	65
SB-10	7/27/2007	2.5 U	162	--	0.71	13.9	4.5	13.2	8.46	526	0.04	--	4 U	0.50 U	48.1
Minimum		2.5 U	162	--	0.69	13.9	4.49	10.7	6.92	500	0.033 U	--	4 U	0.50 U	51.6
Maximum		3.5	253	--	1.09	29.9	6.83	80.9	9.27	768	0.04	--	4 U	0.50 U	65
Upper Waste Rock Pile (UWRP)															
RS-13	7/27/2007	7.55 J	107	1.18	3.06	12.5	7.22	2,740	40.5	816	0.042	3.23	4 U	11.7 J	73.7
S-30	7/27/2007	7.21 J	59.7	1.41	2.79	13.5	8.38	12,600	17.8	746	0.037	3.73	6.67	20.5	69.9
S-31	7/27/2007	2.8 J	49.1	--	2.05	12.7	9.9	11,600	17.9	850	0.033 U	--	8.00	27.4 J	103 J
S-32	7/27/2007	7.3 J	88.5	--	1.64	21.4	10.2	4,110	82.4	1,100	0.033 U	--	4 U	14.8	106
S-33	7/27/2007	14.2 J	82.3	--	4.35	13	34	4,940	448	2,760	0.033 U	--	4 U	26.6	213
Minimum		2.8 J	49.1	1.18	1.64	12.5	7.22	2,740	17.8	746	0.037	3.23	6.67	14.8	69.9
Maximum		14.2 J	107	1.41	4.35	21.4	34	12,600	448	2,760	0.042	3.73	8.00	26.6	213
Lower Waste Rock Pile (LWRP)															
S-36	7/27/2007	12.2	85.3	--	1.59	47.5	9	81.6	10.9	339	0.033 U	--	4 U	0.50 U	72.8
L-1	7/8/2009	5.68	131	0.421	0.281	60.7	10.5	44.9	28	367	0.246	23	0.555 U	0.524 U	88.3
L-2	7/8/2009	15.4	56.3	0.202	0.399	33.9	6.82	52.9	13	288	0.0541	15.7	0.657	0.568 U	73.5
L-3	7/8/2009	5.61	87.3	0.238	0.409	56.4	10.6	39	6.28	355	0.05 U	22.4	0.702	0.536 U	92.3
L-4	7/8/2009	18.9	58.9	0.242	0.378	49.7	7.25	25.2	8.74	298	0.05 U	17.8	0.921	0.534 U	79.5
L-5	7/8/2009	11.2	53.8	0.198	0.542	30.8	5.11	20.5	6.94	258	0.05 U	15.3	1.06	0.579 U	71.2
L-6	7/8/2009	6.36	86.4	0.168 U	0.289	54.7	11.6	41.2	7.76	356	0.05 U	25.8	0.78	0.559 U	93
L-7	7/8/2009	10.2	85.3	0.284	0.564	30.4	9.9	49.3	13	404	0.0753	22.5	0.86	0.510 U	84.5
L-8	7/8/2009	11	43.9	0.167 U	0.311	39.1	7.87	28.5	6.51	339	0.0509	15.5	0.79	0.558 U	69.6
L-9	7/8/2009	2.7	113	0.179 U	0.239 U	71.6	8.53	17.2	3.73	365	0.102	17.5	0.588 U	0.598 U	68.4
L-10	7/8/2009	2.24	176	0.240 U	0.852	14.3	6.56	113	37.8	713	0.252	10.5	0.897 U	0.801 U	104
Minimum		2.24	43.9	0.198	0.281	14.3	5.11	17.2	3.73	258	0.0509	10.5	0.55	0.05 U	68.4
Maximum		18.9	176	0.421	0.852	71.6	11.6	113	37.8	713	0.252	25.8	1.06	0.801 U	104
Areas Outside of Waste Rock Piles															
RS-11	7/27/2007	2.5 UJ	128	--	0.97	17.2	6.47	117	8.26	321	0.033 U	--	4 U	0.50 U	36.1
RS-12/	7/27/2007	2.7 J	87.4	--	1.08	11.1	7.25	711	13.6	370	0.033 U	--	4 U	1.53	50.5
OS-1	7/7/2009	3.9	141	0.351	0.255 U	19.1	4.7	168	7.17	307	0.05 U	10.7	0.753 U	0.638 U	39.1
RS-14	7/27/2007	2.5 UJ	124	--	0.87	19.0	6.21	42.6	6.70	284	0.033 U	--	4 U	0.50 U	35.0
S-15	7/27/2007	2.5 UJ	159	--	1.03	13.9	5.96	22.7	9.52	642	0.033 U	--	4 U	0.50 U	48.3
S-16	7/27/2007	2.7 J	168	--	1.37	17.1	6.43	36.3	10.60	534	0.033 U	--	4 U	0.50 U	59.2
S-17	7/27/2007	4.4 J	234	--	2.75	11.1	13.8	240	13.60	1,450	0.050	--	4 U	0.90	177
S-18/	7/27/2007	2.5 UJ	146	--	1.22	17.2	7.85	839	17.10	673	0.033 U	--	4 U	0.50 U	64.7
O-2	7/7/2009	3.35	158	0.422	0.304	22.2	8.69	744	17.6	657	0.05 U	11.7	0.613 U	0.649 U	73.9
S-19	7/27/2007	2.5 UJ	231	--	1.14	23.5	7.45	105	8.51	802	0.033 U	--	4 U	0.50 U	68.8
S-20	7/27/2007	2.5 UJ	201	--	1.54	32.2	9.81	20.6	7.96	585	0.033 U	--	4 U	0.50 U	62.3
S-21/	7/27/2007	8.01 J	428	4.36	8.27	35.1	14.5	636	12.2	770	0.252	1.26	4 U	3.26	117
O-4	7/7/2009	3.56	233	0.161 U	0.79	34.1	11.9	453	6.03	547	0.124	9.76	0.546 U	0.537 U	99.5
S-22	7/27/2007	2.5 UJ	136	--	1.37	20.8	6.84	25.9	26.40	779	0.033 U	--	4 U	0.50 U	111
S-23	7/27/2007	2.5 UJ	134	--	1.34	23.0	6.80	15.7	17.90	688	0.033 U	--	4 U	0.50 U	88.6
S-24	7/27/2007	2.6 J	89.1	--	1.00	28.9	7.72	16.0	12.10	277	0.033 U	--	4 U	0.50 U	39.1
S-25	7/27/2007	2.5 UJ	195	--	1.79	21.2	6.89	11.4	45.40	921	0.033 U	--	4 U	0.50 U	214
S-26	7/27/2007	2.5 UJ	152	--	1.73	25.0	7.64	43.5	135	370	0.043	--	4 U	1.78	129
S-27	7/27/2007	2.5 UJ	128	--	1.02	20.5	6.85	16.9	12.40	529	0.033 U	--	4 U	0.50 U	66.5
S-28	7/27/2007	2.5 UJ	148	--	1.01	25.5	8.88	56	8.38	513	0.033 U	--	4 U	0.50 U	50.6
S-29	7/27/2007	2.5 UJ	176	--	0.93	17.9	7.26	225	7.50	482	0.033 U	--	4 U	0.61	53.6
S-34/	7/27/2007	4.8 J	138	--	1.52	18	8.5	389	127	807	0.033 U	--	4 U	3.93	133
O-3	7/7/2009	7.22	115	0.754	0.944	23.7	9.98	568	159	835	0.05 U	12.1	0.560 U	1.00	149
S-35	7/27/2007	3 J	151	--	1.34	46.7	7.47	57.8	34.6	755	0.033 U	--	4 U	0.50 U	95.1
Minimum		3.35	115	0.351	0.304	19.1	4.7	168	6.03	307	0.043	9.76	0.546 U	1.00	39.1
Maximum		7.22	428	0.754	8.27	46.7	14.5	839	159	1,450	0.252	12.1	4 U	3.93	214

Notes:

U = The analyte was analyzed for but not detected at or above the reported method reporting limit (MRL).

J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

-- = not analyzed.

Table 3. Mine Site, Background Soil, and Capping Soil Screening (mg/kg)
Kelly Camp Mine EE/CA

Sample Location & ID		Total Metals (mg/kg dry weight)													
		Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Zinc
Candidate Capping Soils															
Cow Camp (A-1)		3.19	50.2	0.243	0.209 U	14.1	4.75	10.1	2.99	177	0.05 U	10.4	0.501 U	0.521 U	17
Storm King (A-2)		2.08	40.6	0.155 U	0.207 U	15.4	4.62	14.5	3.79	225	0.05 U	7.63	0.495 U	0.517 U	29.7 U
Fill 1 (A-3)		2.34	46.1	0.303	0.218 U	21.3	3.84	6.19	6.65	175	0.05 U	11.3	0.535 U	0.545 U	26.3
Fill 2 (A-4)		2.6	105	0.336	0.231 U	16.1	3.96	8.54	6.05	253	0.05 U	8.05	0.568 U	0.578 U	31
Site Soils															
Upper Waste Rock Pile	Minimum	2.8 J	49.1	1.18	1.64	12.5	7.22	2,740	17.8	746	0.037	3.23	6.67	14.8	69.9
	Maximum	14.2 J	107	1.41	4.35	21.4	34	12,600	448	2,760	0.042	3.73	8	26.6	213
Lower Waste Rock Pile	Minimum	2.24	43.9	0.198	0.281	14.3	5.11	17.2	3.73	258	0.0509	10.5	0.55	0.05 U	68.4
	Maximum	18.9	176	0.421	0.852	71.6	11.6	113	37.8	713	0.252	25.8	1.06	0.801 U	104
Samples Outside of Waste Rock Areas	Minimum	3.35	115	0.351	0.304	19.1	4.7	168	6.03	307	0.043	9.76	0.546 U	1	39.1
	Maximum	7.22	428	0.754	8.27	46.7	14.5	839	159	1,450	0.252	12.1	4 U	3.93	214
Site-Wide 95% UCL		6.61	153	1.13	2.36	31.8	10.3	5,422	156	930	0.0751	17.1	1.49	5.17	99.5
Background Soils															
Site-Specific Background Concentration *(range)		2.1 (-)	228 (162- 253)	--	0.97 (0.69 - 1.09)	26.2 (13.9 - 29.9)	6.01 (4.49 - 6.83)	32.5 (10.7 - 80.9)	8.98 (6.92 - 9.27)	693 (500 - 768)	0.026 (-)	--	2	0.25	60.7 (41.4 - 65)
Washington State (east region) Background Concentration ¹		7.61	--	1.3	0.8	31.9	--	28.4	13.1	836.0	0.04	24.5	--	--	80.9

Human Health Soil Screening Criteria															
Ecology MTCA Method A Industrial Soil Cleanup Levels (Table 745-1) ²	20	--	--	2	2,000 (Cr III) 19 (Cr VI)	--	--	1,000	--	2	--	--	--	--	--
Ecology MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses (Table 740-1) ²	20	--	--	2	2,000 (Cr III) 19 (Cr VI)	--	--	250	--	2	--	--	--	--	--
USEPA Industrial Soil RSLs ³	1.6	190,000	2,000	810	1,400	300	41,000	800	23,000	28	20,000	5,100	5,100	310,000	

Ecological Soil Screening Criteria															
Ecology MTCA Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals (Table 749-3) ²															
Plants	10 (As V)	500	10	4	42 ^a	20	100	50	1,100 ^a	0.3	30	1	2	86 ^a	
Soil biota	60 (As V)	--	--	20	42 ^a	--	50	500	--	0.1	200	70	--	200	
Wildlife	7 (As III) 132 (As V)	102	--	14	67	--	217	118	1,500 ^a	5.5	980	0.3	--	360	
USEPA Eco-SSLs ⁴															
Plants	18	--	--	32	--	13	70	120	220	--	38	0.52	560	160	
Soil Invertebrates	--	330	40	140	--	--	80	1,700	450	--	280	4.1	--	120	
Avian	43	--	--	0.77	26 (Cr III)	120	28	11	4,300	--	210	1.2	4.2	46	
Mammalian	46	2,000	21	0.36	34 (Cr III)	230	49	56	4,000	--	130	0.63	14	79	
					130 (Cr VI)										

Notes:

	Shaded values exceed one or more criteria
	Shaded values are exceeded by Site soil or background concentrations.

All chromium is present as Cr III, not as Cr VI, based on the findings of the SI.

All arsenic is present in soil as As V, not as As III, based on the findings of the SI.

-- = not available

* Site-specific background concentrations were calculated as the 90th percentile concentration of the background data set. Since selenium and silver were not detected, the concentrations shown are equal to one-half the method reporting limit (MRL).

^a = benchmark replaced by Washington State (state-wide) natural background concentration.

J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

mg/kg = milligrams per kilogram soil

Maximum = Maximum detection shown for analyte, unless all results are nondetect

Minimum = Lowest minimum detection shown for analyte, unless all results are nondetect.

U = The analyte was analyzed for but not detected at or above the reported method reporting limit (MRL).

Sources:

¹ Ecology, 1994. Natural Background Soil Metals Concentrations in Washington State (east region), Toxics Cleanup Program. Department of Ecology. October.

² Ecology, 2007. Model Toxics Control Act Chapter 70.05D RCW and Cleanup Regulation Chapter 173-340 WAC. Washington State Department of Ecology, Toxics Cleanup Program. Revised November 2007. Publication No. 94-06

³ USEPA, 2009. Regional Screening Levels for Chemical Concentrations at Superfund Sites. U.S. Environmental Protection Agency. Accessed October 2008 at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

⁴ USEPA, 2008. Ecological Soil Screening Levels (Eco-SSLs). Accessed October 2009 online at <http://www.epa.gov/ecotox/ecossl/>

Table 4. Waste Rock ABA Data Summary
Kelly Camp Mine EE/CA

Sample ID	Sample Date	Total Sulfur (wt%)	Sulphate Sulfur (wt%)	Sulfide Sulfur (wt%)*	Insoluble Sulphur (wt%)*	Acid Generation Potential** (kg CaCO ₃ /ton)	Modified Sobek Acid Neutralization Potential (kg CaCO ₃ /ton)	Modified Sobek Net Neutralization Potential (kg CaCO ₃ /ton)	Modified Sobek NPR (NP/MPA)
WR-1	7/27/2007	0.20	0.11	0.04	0.05	1.3	41.7	40.4	33.3
WR-2	7/27/2007	0.01 U	0.00	0.00	0.01 U	0.03	296.4	296.4	9,486.1
WR-3	7/27/2007	0.20	0.03	0.17	0.01 U	5.3	22.5	17.2	4.2
Minimum		0.20	0	0.001	0.05	0.03	22.5	17.2	4.2
Maximum		0.20	0.11	0.17	0.05	5.3	296.4	296.4	9,486.1
Mean		0.20	0.05	0.07	0.05	2.2	120.2	118.0	3,174.6

Notes:

U = The analyte was analyzed for but not detected at or above the reported method reporting limit (MRL).

* Based on difference between total sulfur and sulfate-sulfur

** Based on sulfide-sulfur

AGP = Acid Generating Potential in tons CaCO₃ equivalent per 1,000 tons of material.

ANP = Modified Sobek Neutralization Potential in tons CaCO₃ equivalent per 1,000 tons of material.

NNP=ANP-AGP

NPR = ANP / AGP

**Table 5. TCLP and SPLP Results and SPLP Screening
Kelly Camp Mine EE/CA**

	Analysis of Metals (mg/L)											
	Arsenic	Barium	Cadimium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Selenium	Silver	Zinc
TCLP												
WR-1	0.05U	1.00U	0.010U	0.050U	0.014	124	0.0818	7.51	0.0002U	0.05U	0.05U	0.33
WR-2	0.05U	1.00U	0.010U	0.050U	0.016	2.07	0.0500U	1.44	0.0002U	0.05U	0.050U	0.029
WR-3	0.05U	1.00U	0.010U	0.050U	0.006U	0.297	0.0500U	1.91	0.0002U	0.05U	0.050U	0.100
Blast Rock WR-4	0.05U	1.00U	0.010U	0.050U	0.017	6.7	0.176	10.3	0.0002U	0.05U	0.050U	0.112
SPLP												
WR-1	0.02U	0.002U	0.002U	0.006U	0.006U	0.01	0.0075U	0.004U	0.0002U	0.040U	0.005U	0.01U
WR-2	0.02U	0.002	0.002U	0.006U	0.006U	0.01	0.0075U	0.004U	0.0002U	0.040U	0.005U	0.01U
WR-3	0.02U	0.003	0.002U	0.006U	0.006U	0.01U	0.0075U	0.004U	0.0002U	0.040U	0.005U	0.01U
Blast Rock WR-4	0.02U	0.007	0.002U	0.006U	0.006U	0.01	0.0075U	0.004U	0.0002U	0.040U	0.005U	0.01U
Maximum Detected Concentrations												
MDC in Mine Water	0.0030 U	0.0056	0.0020 U	0.006 U	0.006 U	0.211	0.0075 U	0.117	0.00020 U	0.04 U	0.005 U	0.036
MDC in TCLP Leachate	0.05U	1.00U	0.010U	0.050U	0.017	124	0.176	10.3	0.0002U	0.05U	0.050U	0.33
MDC in SPLP Leachate	0.02U	0.007	0.002U	0.006U	0.006U	0.01	0.0075U	0.004U	0.0002U	0.040U	0.005U	0.01U
TCLP Regulatory Levels ^{a,1}												
	5	100	1	5	--	--	5	--	0.2	1	5	--
Leachate Screening Criteria												
WDOE Method A Cleanup Levels for Groundwater ^{b,2} (modified for comparison to leachate)	<u>0.005</u>	--	0.05	0.05	--	--	0.150	--	0.002	--	--	--
WDOE Method B Cleanup Levels for Groundwater ^{b,2} (modified for comparison to leachate)	<u>4.80E-03</u>	3.2	0.08	24 (Cr ³⁺)	--	0.592	--	2.2	0.0048	0.08	0.08	48
WDOH MCLs ³	<u>0.010</u>	2	0.005	0.1	--	1.3 ^c	0.015 ^c	0.05 ^d	0.002	0.05	0.1 ^d	5 ^d
EPA Drinking Water MCLs ⁴	<u>0.010</u>	2	0.005	0.1	--	1 ^d	0.015	0.05 ^d	0.002	0.05	0.1 ^d	5 ^d

Notes:

 Underlined criterion is not exceeded but detection limits are higher than the criteria.

Only MDCs of SPLP results were compared to leachate screening criteria.

Ecological screening criteria for water are presented in Table 2.

MDC = maximum detected concentration

SPLP = Synthetic Precipitation Leaching Procedure

TCLP = Toxicity Characteristics Leaching Procedure

-- = no screening criterion was available for this analyte

^a = TCLP results exceeding TCLP Regulatory Levels suggest that the material is a hazardous waste due to its toxicity.

^b = Modification to WDOE screening criteria: cadimium, lead, and zinc concentrations were multiplied by 10 per WAC 173-340-747(7).

^c = action level

^d = secondary criteria

Sources:

¹ 40 CFR 261.24 Toxicity Characteristics

² WDOE. 2005. Model Toxics Control Act Chapter 70.05D RCW and Cleanup Regulation Chapter 173-340 WAC. Washington State Department of Ecology, Toxics Cleanup Program. Revised October 2005. Publication No. 94-06

³ WAC 2004. Washington Administrative Code 246-290-310. Maximum Contaminant Levels (MCLs)

⁴ EPA Drinking Water MCLs. EPA. 2006 National Recommended Water Quality Criteria. Office of Water, Office of Science and Technology.

Table 6. Soil Quality ARARs and Proposed Cleanup Criteria (mg/kg)
Kelly Camp Mine EE/CA

Analyte	Background Concentration ^a	Washington State (East Region) Background Soil Concentrations	Maximum Detected Site Concentration	State of Washington			Federal		Proposed Soil Cleanup Criteria
				WAC 173-340-740	WAC 173-340-7492	WAC 170-340-7493	EPA Industrial Soil RSLs	EPA Ecological SSLs ^c	
				MTCA Method A Industrial Soil (Table 745-1)	MTCA Method A Unrestricted Land Use (Table 740-1)	MTCA Ecological Indicator Soil Concentrations (Table 749-3) ^b			
Arsenic	2.1	7.61	18.9	20 (As ³)	20 (As ³)	10p (As ⁵)	1.6	18p	10
Barium	228	--	428	NS	NS	102w	190,000	330s	228
Beryllium	--	1.3	1.41	NS	NS	10p	2,000	21m	10
Cadmium	0.97	0.8	8.27	2	2	4p	800	0.36m	0.97
Chromium	26.2	31.9	71.6	19 (Cr ⁶) 2,000 (Cr ³)	19 (Cr ⁶) 2,000 (Cr ³)	42 ^d p,s	1,400	26 (Cr ³)a	31.9
Cobalt	6.01	--	34	NS	NS	20p	300	13p	13
Copper	32.5	28.4	12,600	NS	NS	50s	41,000	28a	32.5
Lead	8.98	13.1	448	1000	250	50s	800	11a	13.1
Manganese	693	836	2,760	NS	NS	1,100p	23,000	220p	836
Mercury	0.026	0.04	0.252	2	2	0.1s	24	NS	0.1
Nickel	--	24.5	25.8	NS	NS	30p	20,000	38p	30
Selenium	2*	--	8.00	NS	NS	0.3w	5,100	0.52p	2
Silver	0.25*	--	26.6	NS	NS	2p	5,100	4.2a	2
Zinc	60.7	80.9	214	NS	NS	86p	310,000	46a	60.7

Notes:

	Shaded values exceed one or more criteria
	Shaded values exceeded by Site or Background concentrations.

Bold value selected as Proposed Soil Cleanup Level.

mg/kg = milligrams per kilogram.

-- = Not available.

^a 90th percentile concentration of ten background samples.

^b Lowest value selected from plant(p), soil biota(s), and wildlife(w) receptors.

^c Lowest value selected from plant(p), soil invertebrate(s), avian(a), and mammalian(m) receptors.

^d Benchmark replaced by Washington State (state-wide) natural background concentration.

* Selenium and silver were not detected. Values shown are one-half the MRL.

ARAR = Applicable or relevant and appropriate requirement

EPA = U.S. Environmental Protection Agency

MTCA = Model Toxics Control Act

NS = No standard

RSL = Regional Screening Level

SSL = Soil Screening Levels

WAC = Washington Administrative Code

Table 7. Removal Action Technology Screening Matrix
Kelly Camp Mine
EE/CA

Technology Class	Process Option	Description	Effective-ness	Implemen-tability	Cost	O&M	Land Impact	Pros	Cons	Retained?
No Action										
No action	No action	Leave feature(s) as is	0	0	0	None	None	Cheap, easy	No risk reduction	Yes
Institutional Controls										
Access Restriction	Barbed-wire fencing	3-strand barbed-wire fence around	Low	High	Low	Medium–subject to vandalism	Minimal	Simple	Only a mild impediment to access	No
	Chain-link fencing	8-foot chain-link security fence around site	Medium	Low	High	Medium–subject to vandalism	Visual contrast	Simple, more effective than barbed-wire	Difficult to install on steep, uneven slopes	No
	Warning signs	Signs posted at physical hazards to warn of potential risks	Low	High	Low	Medium–subject to vandalism	Minimal	Simple, more effective than barbed-wire	Difficult to install on steep, uneven slopes; does not provide a physical barrier to site access	No
Physical Hazards										
Access restriction	Bat gate	Install bat gate in open adits and shafts	High	High	Low	Medium–subject to vandalism	None	Reduces ecoreceptor exposure; prevents human access; maintains bat habitat	Not natural looking, potential vandalism	Yes
	Backfill open shaft	Backfill open shaft	High	Medium	low	Low–subject to further subsidence	Low	Eliminates physical hazard; may be able to use waste rock for fill material	Potential for future collapse; reduces potential bat habitat	Yes
	Plug open shaft	Install PUF or concrete plug in addition to backfill and cover	Medium	Medium	Medium	Low–inspect for vandalism	Minimal	Eliminates physical hazard	Reduces potential bat habitat	No
	Cap open shaft with cupola	Install bat cupola over open shaft	High	Medium	Low	Low–inspect for sloughing around cap and vandalism	Minimal	Eliminate physical hazard; not as prone to collapse; maintains bat habitat	Not natural looking, potential vandalism	No
Engineering Controls										
Solids Containment	Geosynthetic cover	Engineered multilayer cover with a synthetic liner (GCL or HDPE)	High	Medium	High	Low–inspect for erosion	~ 0.3 acre cover over UWRP	Prevents physical contact with mine wastes; eliminates infiltration through waste material	Must be installed/tested correctly; prevention of leaching/infiltration not necessary at Site	No
	Clay cover	Bentonite or composite clay geosynthetic cover + soil & seed	High	Medium	Medium	High–clay subject to desiccation in semi-arid climate		Prevents physical contact with mine wastes; nearly eliminates infiltration; more forgiving installation than geosynthetics	Clay prone to decomposition from desiccation and freeze/thaw; prevention of leaching/infiltration not necessary at Site	No
	Biological cover	Add carbohydrate– or protein–based nutrient mixes to cover soil	Low	High	Medium	Low–inspect for erosion		Reduced leachate metals concentrations	Does not prevent physical contact with soil; strongly depends on mixture; design parameters not developed; prevention of leaching/infiltration not necessary at Site	No
	Cementitious cover	Fiber–reinforced concrete/mortar cover	High	Medium	High	Low–inspect for erosion		Prevents physical contact with mine wastes; reduced leachate metals concentrations	Subject to cracking; not natural looking	No
	Polyurethane grout	Spray cover of polyurethane grout to inhibit infiltration	Medium	Medium	Medium	Low–inspect for erosion		Prevents physical contact with soil; reduced infiltration and leachate metals concentrations; more plasticity than cement grouts	Long term stability unknown; not natural looking	No

Technology Class	Process Option	Description	Effective-ness	Implemen-tability	Cost	O&M	Land Impact	Pros	Cons	Retained?
Solids Containment (continued)	Native soil cover	Soil cover constructed from native soils obtained from local sources	Medium	High	Low	Low—inspect for erosion	~ 0.3 acre cover over UWRP	Prevents physical contact with mine wastes; natural looking; suitable growing medium for vegetation	May not prevent physical contact with soil for burrowing organisms	Yes
Land Disposal										
On-site repository	Constructed repository	Excavate waste rock and place in on-site repository	High	High	Medium	Medium—inspect cap and analyze leachate; inspect reclaimed areas	<1 ac (reclaimed)	Reduces direct exposure	Wastes remain on Site; provides no advantage over capping in place	No
Off-site repository	Constructed repository	Excavate waste rock and place in off-site repository	High	High	Medium	Medium—inspect cap and analyze leachate; inspect reclaimed areas	<1 ac (reclaimed)	Eliminates direct exposure on Site	Wastes and associated risks simply transferred to another location; provides no advantage over on-site alternatives	No
Off-site disposal	Landfill	Excavate waste rock and dispose in landfill	High	High	High	Low—material hauled off site; inspect reclaimed areas	None	Eliminates direct exposure by removing waste from Site	Risk of highway spills	Yes
Treatment										
Solidification/stabilization	Stabilization	Inject waste rock with cement or other material to physically stabilize	Medium to High	High	Medium	Low—inspect for erosion/settling	Minimal for access to waste rock piles	Does not require waste excavation	More expensive than other on-site technologies	No
Vitrification	Vitrification	Heat waste rock >2800°F to melt minerals	High	Low	High	Low—inspect for erosion/settling	Minimal for access to waste rock piles	Does not require waste excavation	Requires high energy source; high cost compared to other on-site technologies	No
Washing	Washing	Excavate and wash waste rock with aqueous solution	Medium	Low	High	Low—inspect for erosion/settling	Minimal for access to waste rock piles and wash areas	Reduces waste toxicity	Requires water source, significant waste handling, and chemical disposal	No

**Table 8. Comparison of Aggregate Source Metals
Concentrations to Proposed Cleanup Criteria (mg/kg)
Kelly Camp Mine EE/CA**

Analyte	Proposed Soil Cleanup Criteria	Fill #1	Fill #2
Arsenic	10	2.34	2.6
Barium	228	46.1	105
Beryllium	10	0.303	0.336
Cadmium	0.97	0.218 U	0.231 U
Chromium	31.9	21.3	16.1
Cobalt	13	3.84	3.96
Copper	32.5	6.19	8.54
Lead	13.1	6.65	6.05
Manganese	836	175	253
Mercury	0.1	0.05 U	0.05 U
Nickel	30	11.3	8.05
Selenium	2	0.535 U	0.568 U
Silver	2	0.545 U	0.578 U
Zinc	60.7	26.3	31

Notes:

mg/kg = milligrams per kilogram.

U = The analyte was analyzed for but not detected at or above the reported method reporting limit (MRL).

Table 9. Estimated Removal Action Cost Summary
Kelly Camp Mine EE/CA

Task	Description	Alternative 1	Alternative 2	Alternative 3	Recommended Alternative Cost
Removal Action Construction	Mobilization/Demobilization	\$0	\$13,700	\$18,000	\$13,700
	Erosion Control and Decon. Station		\$5,500	\$5,500	\$5,500
	Clearing, Grubbing, and Site Improvements		\$2,400	\$2,400	\$2,400
	Excavate, Overexcavate ¹ , Transport, and Place LWRP		\$1,700	\$0	\$1,700
	Excavate and Overexcavate ² Waste Rock and Transport to Transfer Area		\$0	\$3,400	\$0
	Load, Transport, and Dispose Waste Rock		\$0	\$95,119	\$0
	Borrow, Transport, and Place Capping Soil		\$10,600	\$0	\$10,600
	Purchase, Import, and Place Compost		\$34,100	\$34,100	\$34,100
	Seed Application and Place Woody Debris		\$2,100	\$2,100	\$2,100
	Backfill Excavations, Pits, Trenches		\$500	\$500	\$500
	Backfill Shafts		\$1,000	\$2,000	\$1,000
	Bat Gates		\$22,000	\$22,000	\$22,000
	O&M (Monitoring)		\$11,500	\$11,500	\$11,500
	Removal Action Construction Subtotal		\$105,000	\$197,000	\$105,000
	20% Contingency		\$21,000	\$39,000	\$21,000
	Removal Action Construction Total		\$126,000	\$236,000	\$126,000
Oversight/Reporting	Work Plan, CQAP, HASP	\$0	\$10,000	\$10,000	\$10,000
	Removal Action Oversight		\$15,000	\$18,000	\$15,000
	Removal Action Report		\$7,000	\$10,000	\$7,000
	Oversight/Reporting Total		\$32,000	\$38,000	\$32,000
TOTAL COST		\$0	\$158,000	\$274,000	\$158,000

Notes:

⁽¹⁾ For Alternative 2, the cost to excavate and consolidate the LWRP assumes a 20 percent increase in excavated soil volume associated with overexcavation of underlying native soils (see Data Gap #1 in EE/CA report).

⁽²⁾ For Alternative 3, the cost to excavate, transport, and dispose of the LWRP and UWRP also assumes a 20 percent increase in excavated soil volume associated with overexcavation of underlying native soils (see Data Gap #1 in EE/CA report).

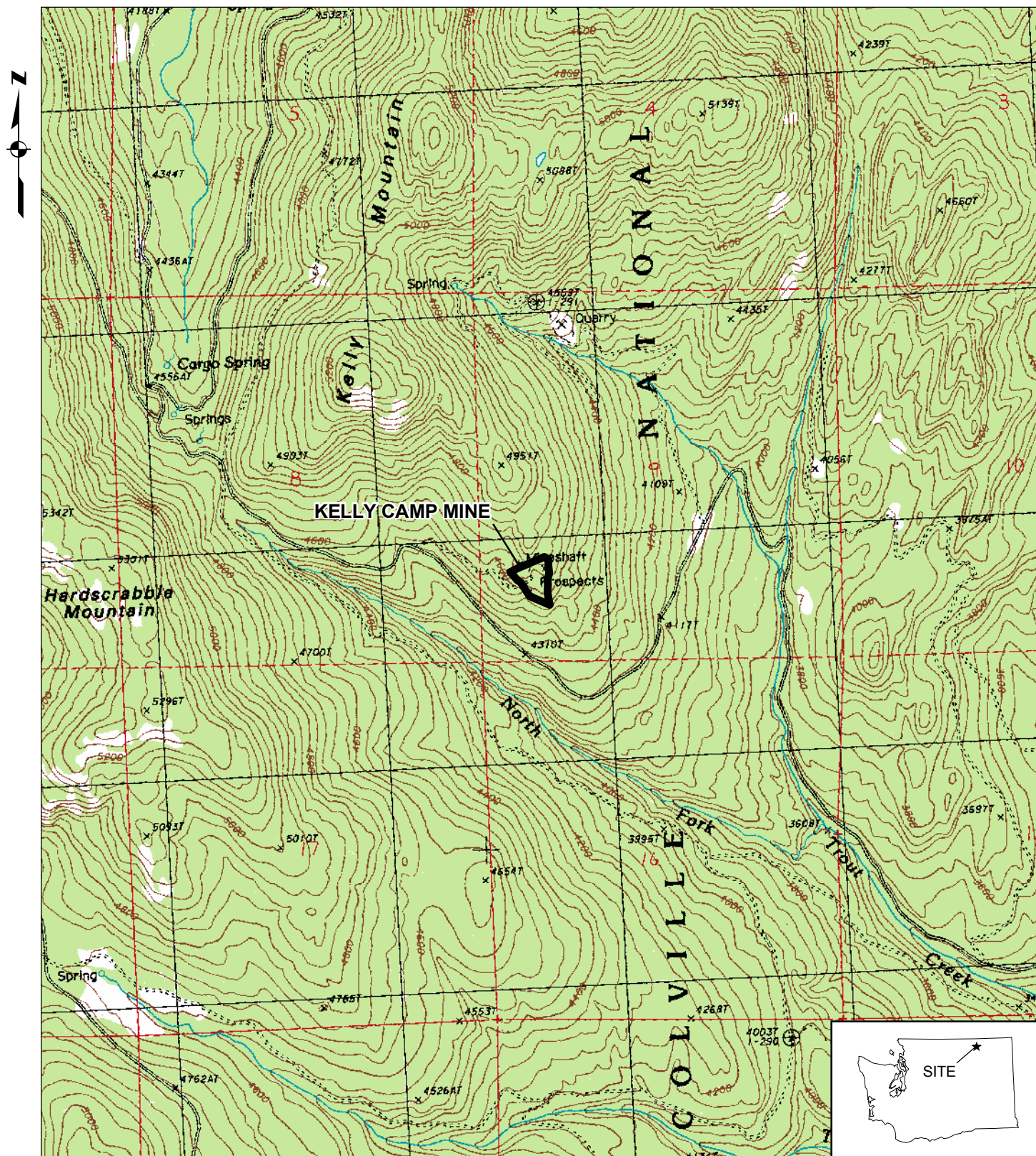
Table 10. Comparative Analysis of Removal Action Alternatives
Kelly Camp Mine EE/CA

Assessment Criteria	Alternative 1 - No Action	Alternative 2 - Consolidation and On-Site Capping	Alternative 3 - Excavation and Off-Site Disposal
Compliance with Removal Action Goals and Objectives			
Attributes:	Does not comply	Waste capped with soil that meets cleanup criteria	Waste material removed from site and physical hazards mitigated.
Advantages:	None	Reduces exposure of ecological receptors to waste rock	Eliminates potential exposure at site
Overall Protectiveness of Public Health, Safety and Welfare			
Attributes:	No protection	All waste rock exceeding cleanup criteria encapsulated on site	All waste material exceeding cleanup levels removed from site
Advantages:	None	Prevents direct human exposure to waste rock Eliminates risk to community from long-distance transport of waste	Higher level of human protection Eliminates potential for future releases at the site
Environmental Protectiveness			
Attributes:	No protection	Waste capped with soil that meets cleanup criteria	All waste material exceeding cleanup levels removed from site
Advantages:	None	High level of ecological protection	Higher level of ecological protection Eliminates potential for future releases at the site
Compliance with Key ARARs			
Attributes:	Does not comply	Moderate compliance with Soil ARARs Moderate to high compliance with Solids Disposal ARARs High compliance with FP S&G ARARs	Moderate compliance with Soil Quality ARARs High compliance with Solids Disposal ARARs High compliance with FP S&G ARARs
Advantages:	None	Complies with ARARs	Eliminates potential for future non-compliances from waste material
Long-term Effectiveness and Permanence			
Attributes:	No action	Waste capped on site with soil; effectiveness depends on re-establishment of vegetation; bat gates may be subject to vandalism	Waste source removed from site; bat gate may be subject to vandalism
Advantages:	None	Effective and provides long-term permanence	Most effective and permanent long term
Reduction of Toxicity, Mobility, and Volume			
Attributes:	No action	No reduction in toxicity or mobility, but waste is capped	No reduction in toxicity or mobility, but waste is removed from site
Advantages:	None	Direct exposure to waste is significantly reduced	Complete reduction of waste volume Most likely for reduction of mobility
Short-Term Effectiveness			
Attributes:	No action	Waste encapsulated on site within one field season; short-term effectiveness is immediate	Waste removed from the site within one field season
Advantages:	None	Easily to construct Minimal risk to community and workers Does not require off-site transport of waste	Most easily constructed Minimal risk to community and workers

**Table 10. Comparative Analysis of Removal Action Alternatives
Kelly Camp Mine EE/CA**

Assessment Criteria	Alternative 1 - No Action	Alternative 2 - Consolidation and On-Site Capping	Alternative 3 - Excavation and Off-Site Disposal
Implementability			
Attributes:	Not applicable	Waste consolidation and capping accomplished using standard construction equipment and methods	Waste removal, transport, and site reclamation accomplished using standard construction equipment and methods
Advantages:	None	Easily implemented; technically and administratively feasible	Easiest to implement; technically and administratively feasible.
Estimated Total Present Worth Cost			
Attributes	\$0	\$158,000	\$274,000
Advantages (cost savings over most expensive option):	\$274,000	\$116,000	\$0

FIGURES



Source: Bodie Mountain, Washington USGS 7.5' Topographic Quadrangle, 1992.

0 0.2 0.4
Miles

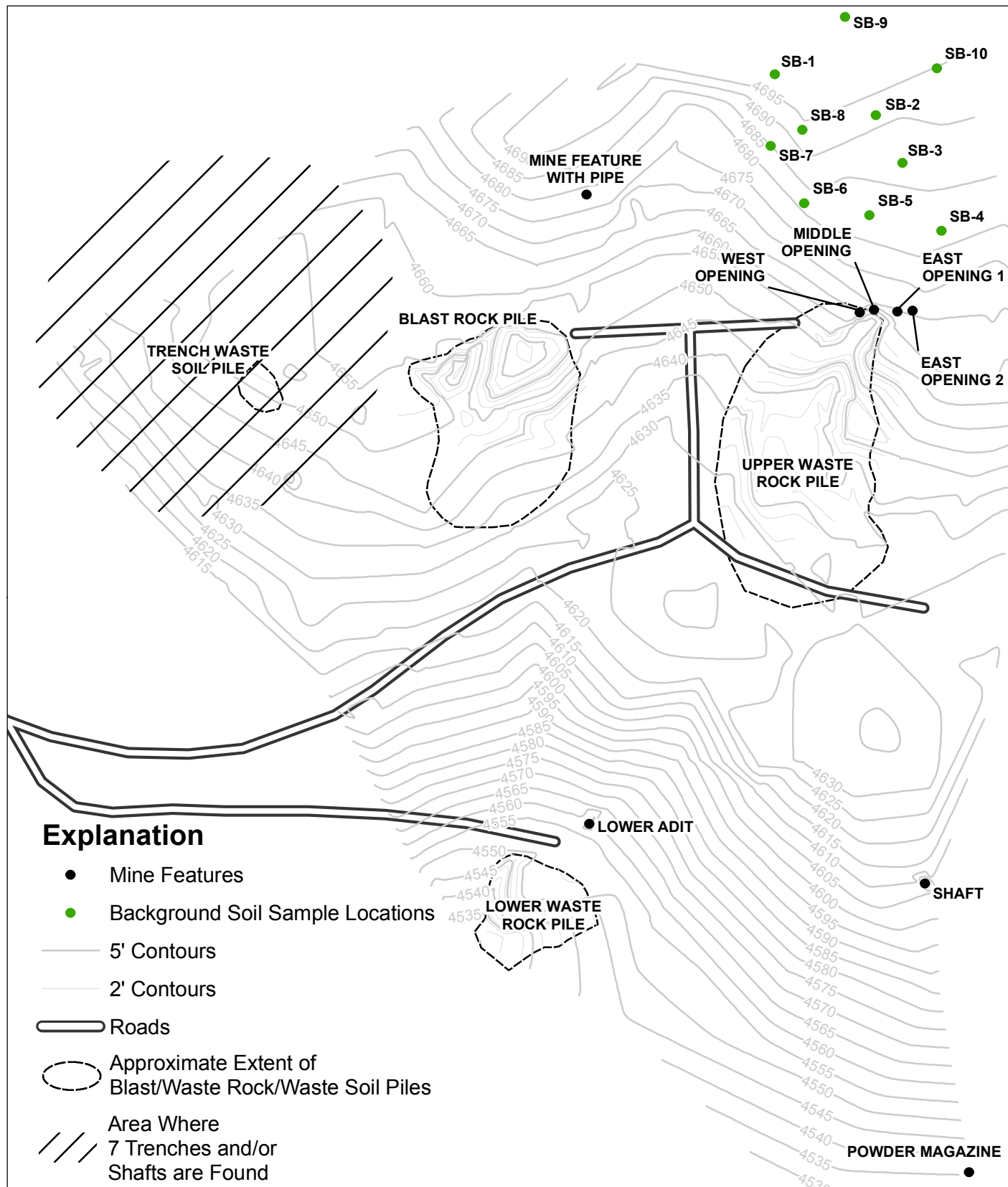
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DECEMBER 2009
25697011

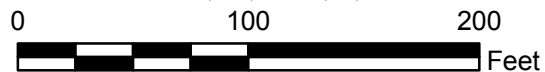
VINICITY MAP

UNITED STATES FOREST SERVICE
KELLY CAMP MINE EE/CA
REPUBLIC, WASHINGTON

FIGURE 1



SOURCE: ROADS - COLEVILLE NATIONAL FOREST GIS.
CONTOURS - THOMAS, DEAN, & HOSKINS, INC., 2007



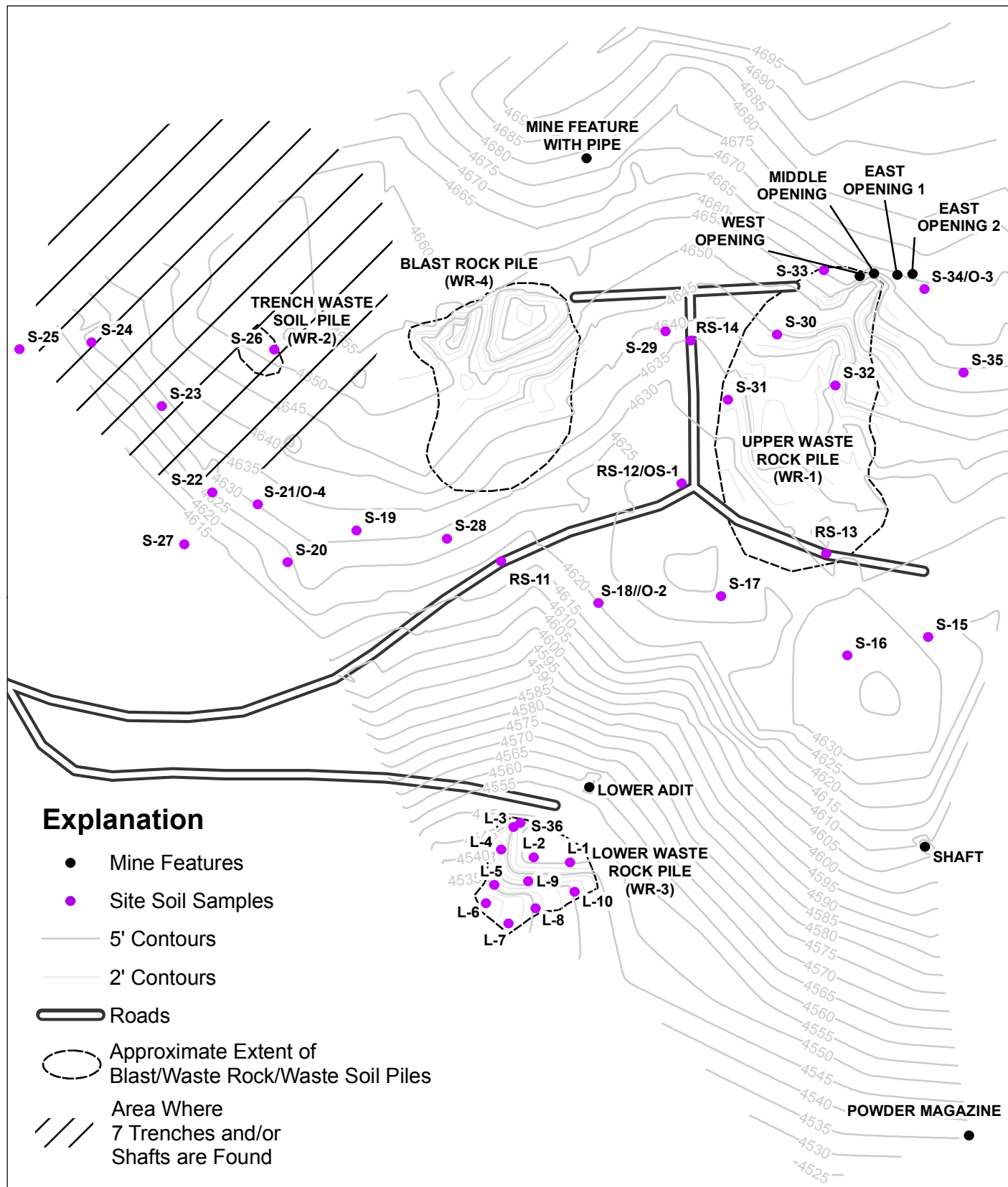
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MINE SITE MAP AND BACKGROUND SOIL SAMPLE LOCATIONS

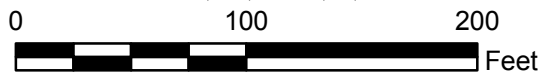
DECEMBER 2009
25697011

UNITED STATES FOREST SERVICE
KELLY CAMP MINE EE/CA
REPUBLIC, WASHINGTON

FIGURE 2



SOURCE: ROADS - COLEVILLE NATIONAL FOREST GIS.
CONTOURS - THOMAS, DEAN, & HOSKINS, INC., 2007



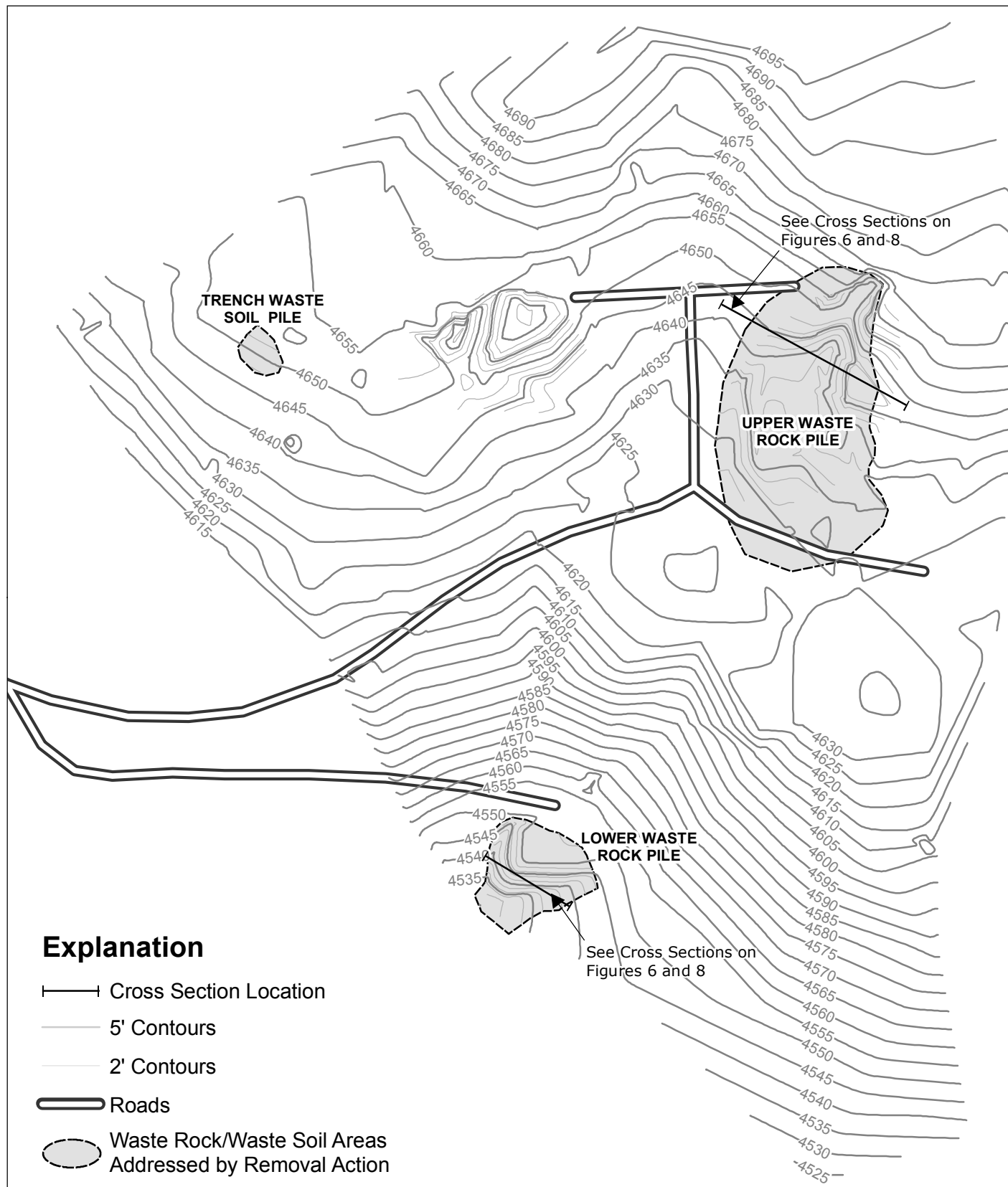
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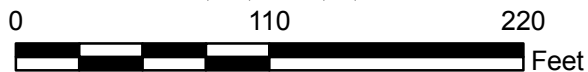
SITE SOIL SAMPLE LOCATIONS

UNITED STATES FOREST SERVICE
KELLY CAMP MINE EE/CA
REPUBLIC, WASHINGTON

FIGURE 3



SOURCE: ROADS - COLEVILLE NATIONAL FOREST GIS.
CONTOURS - THOMAS, DEAN, & HOSKINS, INC., 2007



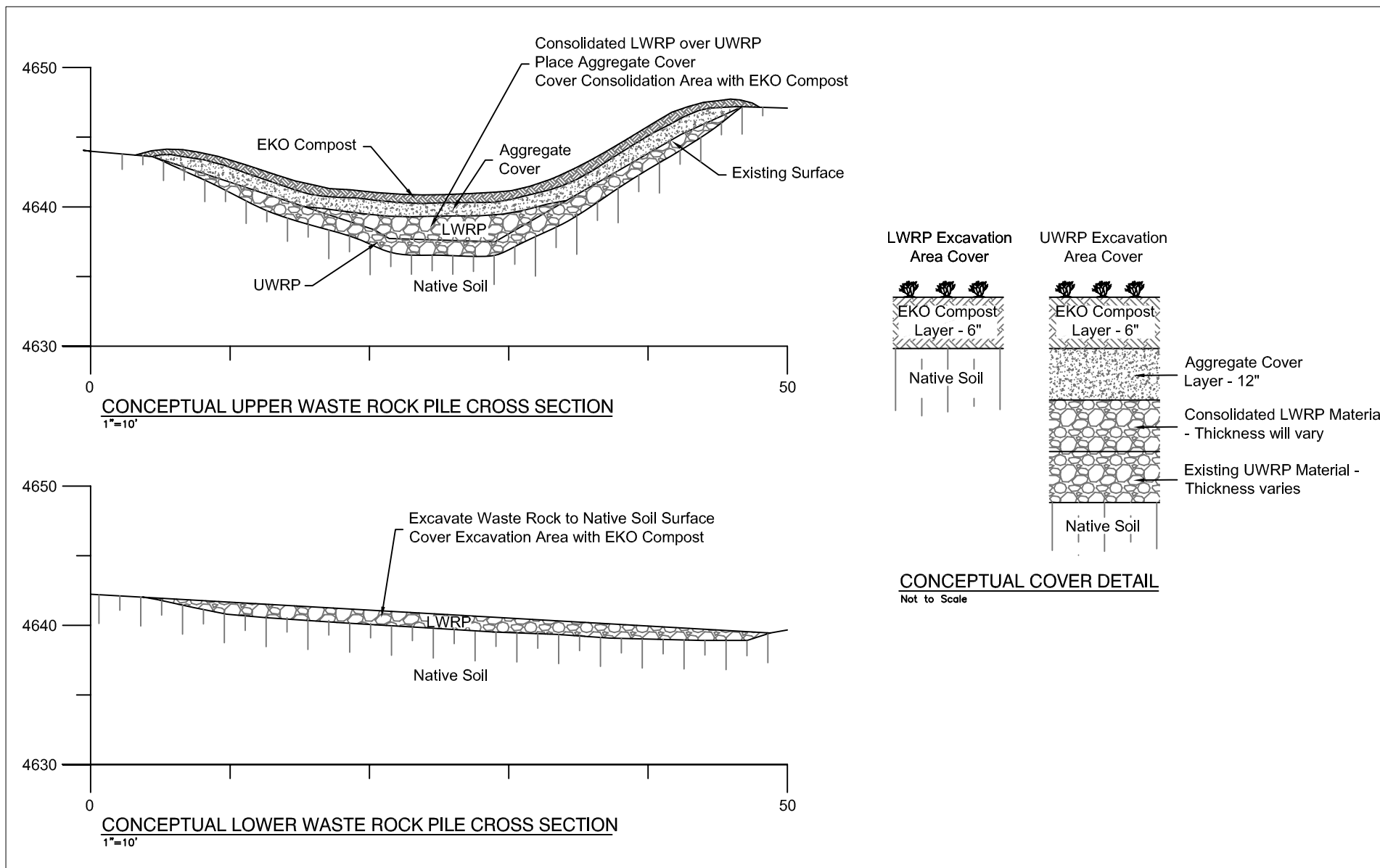
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WASTE ROCK AREAS ADDRESSED BY REMOVAL ACTION

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25697011

UNITED STATES FOREST SERVICE
KELLY CAMP MINE EE/CA
REPUBLIC, WASHINGTON

FIGURE 5



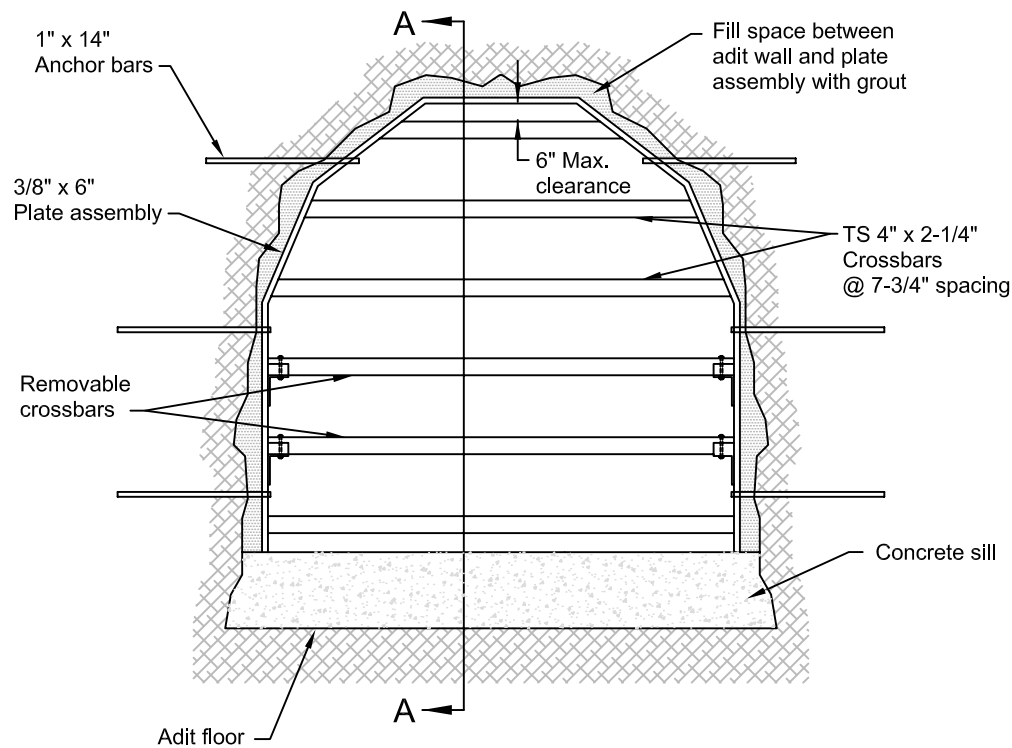
CONCEPTUAL DESIGN FOR CONSOLIDATION AND ON-SITE CAPPING

DECEMBER 2009
25697011

UNITED STATES FOREST SERVICE
KELLY CAMP MINE EE/CA
REPUBLIC, WASHINGTON



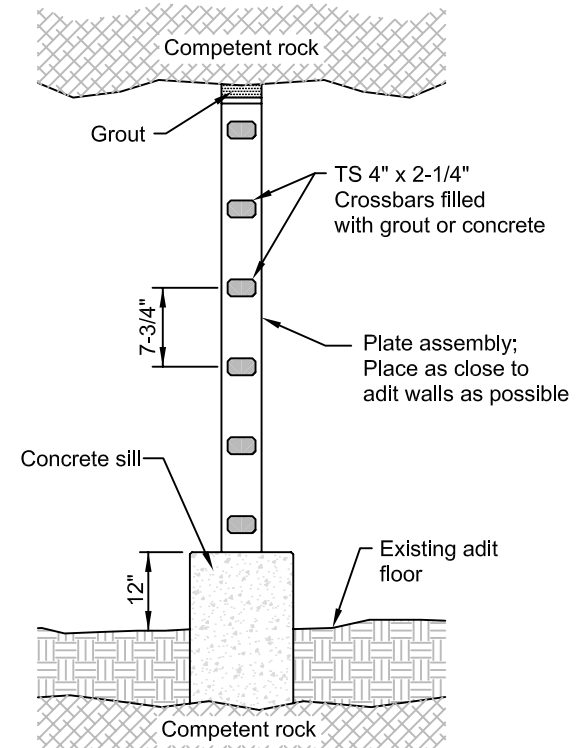
FIGURE 6



BAT GATE ELEVATION

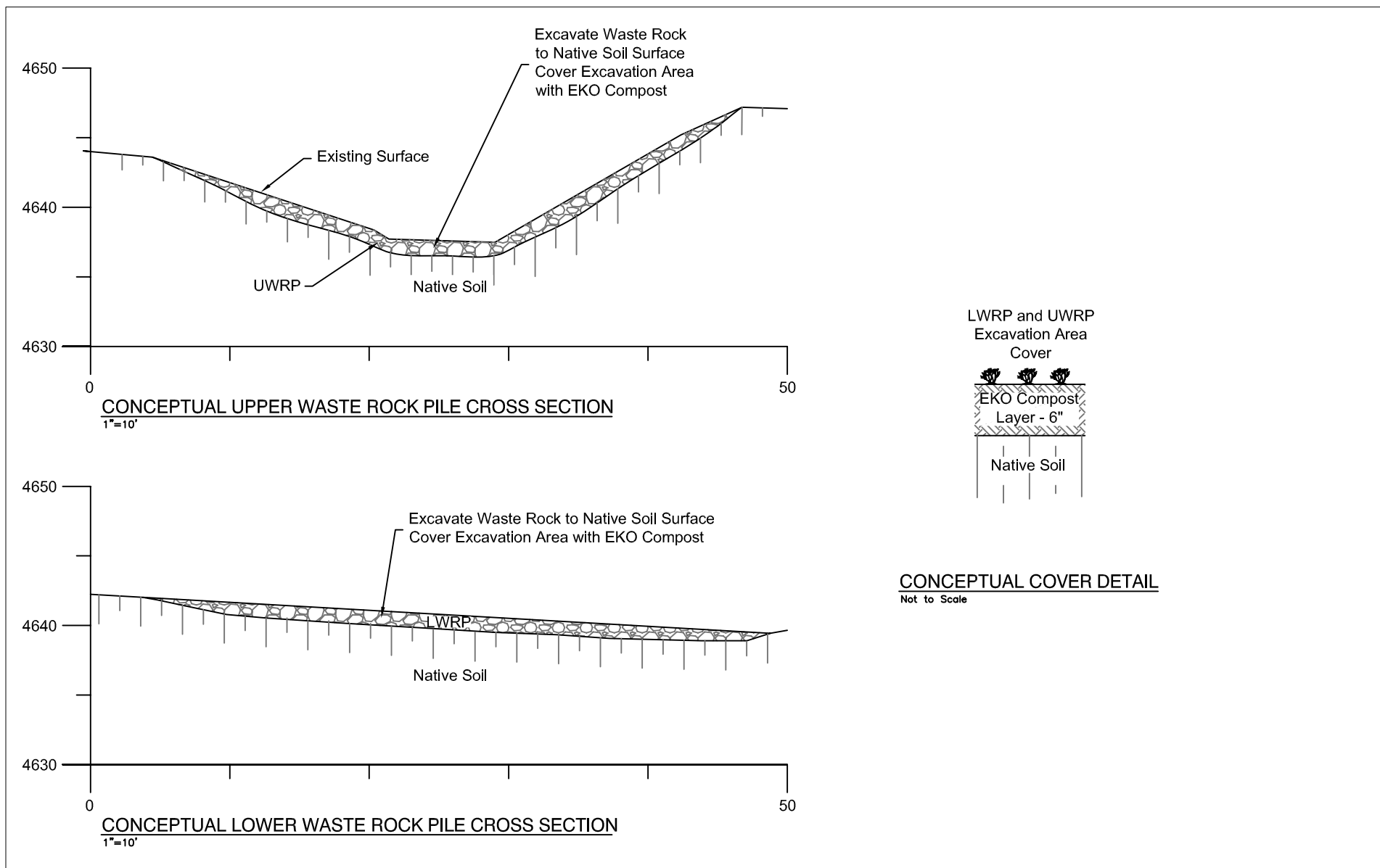
Not to scale

**CONCEPTUAL DESIGN
DRAWINGS ONLY -
NOT INTENDED FOR
CONSTRUCTION**



SECTION A-A

Not to scale



CONCEPTUAL DESIGN FOR EXCAVATION AND OFF-SITE DISPOSAL

DECEMBER 2009
25697011

UNITED STATES FOREST SERVICE
KELLY CAMP MINE EE/CA
REPUBLIC, WASHINGTON

URS

FIGURE 8

APPENDIX A
Site Photographs

Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 1	Date: July-07		
Direction Photo Taken: View to north.			
Description: Photo of entrance to main working/stope (right). A supplemental shaft (left) also accesses the stope. Note copper carbonate (blue-green mineral coating) between openings.			

Photo No. 2	Date: July-07	
Direction Photo Taken: View to north.		
Description: Photo of western opening (shaft) to main working/stope.		

Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 3	Date: July-07		
Direction Photo Taken: View to north.			
Description: Photo of middle (primary) opening to main working/stope.			

Photo No. 4	Date: July-07	
Direction Photo Taken: View to west, from opening in ground surface.		
Description: Photo of main working/stope looking through one of the eastern shafts; note wood debris in upper center of photo.		

Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 5	Date: July-07		
Direction Photo Taken: View to west.			
Description: Photo of standing water within main working/stope.			

Photo No. 6	Date: July-07	
Direction Photo Taken: View of ground surface.		
Description: Photo of one of the smaller shafts to the east of the primary opening to the main working/stope.		

Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 7	Date: July-07		
Direction Photo Taken: View to north.			
Description: Photo of winze within main working/stope (note ladder accessing the winze). Light is entering the stope from one of the eastern shafts.			

Photo No. 8	Date: July-07
Direction Photo Taken: View to north.	
Description: Center of upper main working/stope waste rock pile (UWRP). The primary entry is directly in front of where the person is standing. It appears that a portion of the waste rock pile has been removed (the area under the red line). The finer grained soil within the piles has also been pointed out.	

A photograph of a steep, rocky slope in a forested area. A person wearing a green shirt and a hat is standing on a pile of rocks in the center of the slope. A red horizontal line is drawn across the middle of the slope, indicating a specific level or boundary. A red arrow points to a pile of rocks at the bottom left, which is labeled "fine-grained soil" in a red box. The slope is covered with various sizes of rocks and some sparse vegetation. The background shows more trees and a clear sky.

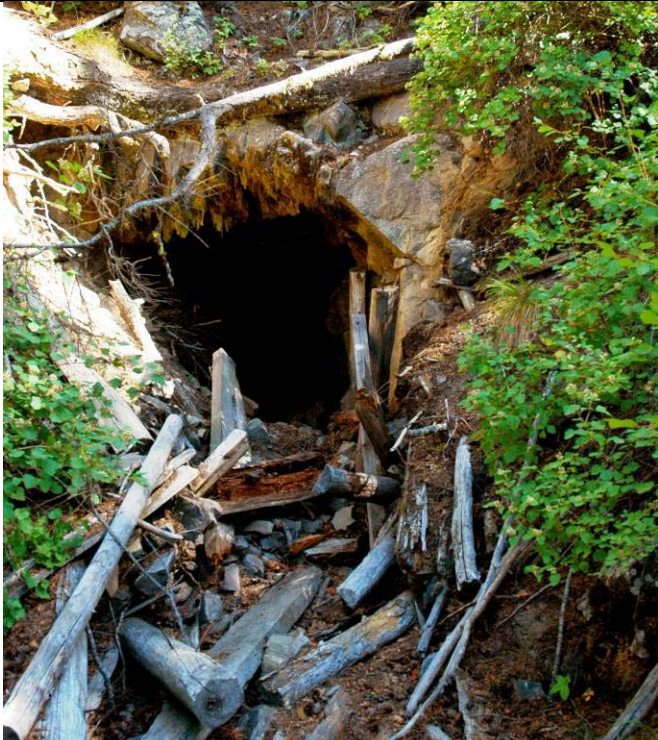
Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 9	Date: July-07		
Direction Photo Taken: View to north.			
Description: Photo of lower adit portal.			

Photo No. 10	Date: July-07	
Direction Photo Taken: View to southwest.		
Description: Photo of former wood structure adjacent to lower adit. Lower adit waste rock pile (LWRP) is located partially beneath former structure. Photo taken from above and from the direction of main workings area.		

Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 11	Date: July-07		
Direction Photo Taken: View to southeast.			
Description: Photo of wood structure remnants near lower adit, overlying the LWRP.			

Photo No. 12	Date: July-07	
Direction Photo Taken: View to the west, northwest.		
Description: Photo of blast rock pile.		

Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 13	Date: July-07		
Direction Photo Taken: View to the west.			
Description: Photo of the north face of the blast rock and rock face where blasting likely occurred.			

Photo No. 14	Date: July-07	
Direction Photo Taken: View of ground surface.		
Description: Photo of example bore in blast rock pile.		

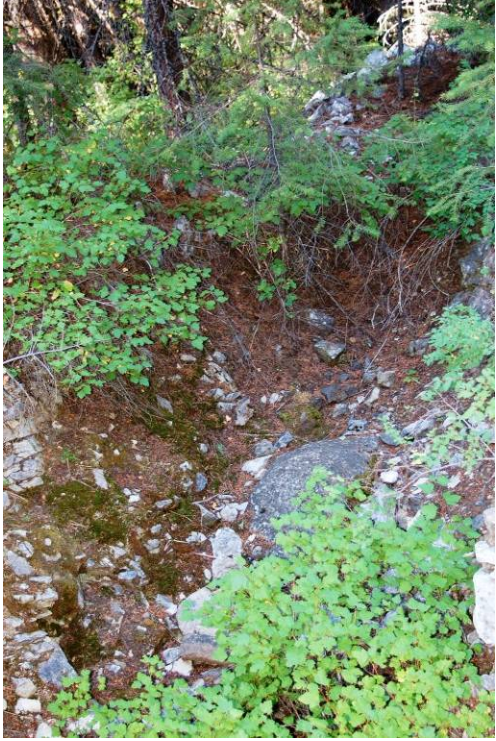
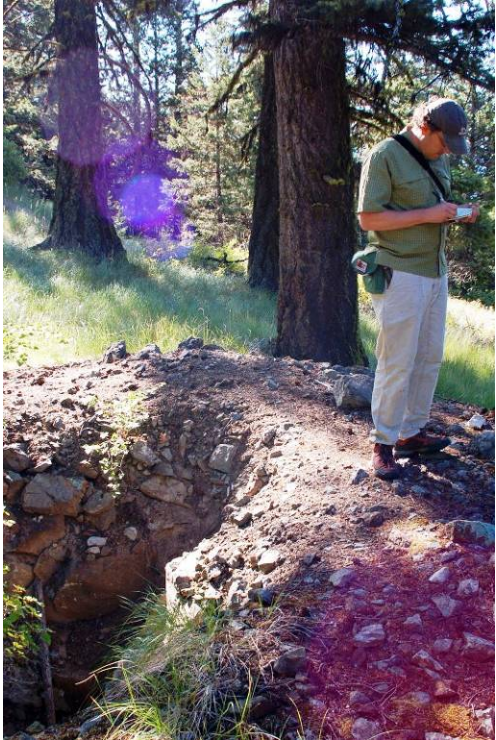
Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 15	Date: July-07		
Direction Photo Taken: View to north.			
Description: Photo showing example trench work at the site.			

Photo No. 16	Date: July-07	
Direction Photo Taken: View of ground surface.		
Description: Photo of an additional example trench at the site.		

Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 17	Date: July-07		
Direction Photo Taken: View to north.			
Description: Close up of mine feature with pipe that is a suspected storage area for explosives.			

Photo No. 18	Date: July-07	
Direction Photo Taken: View to north.		
Description: Photo of road leading to main working/stope and blast rock pile.		

Toe of Blast Rock Pile

Road

Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 19	Date: July-07		
Direction Photo Taken: View to northeast			
Description: Close-up of winze in main working/stope. Note woodrat midden.			

Photo No. 20	Date: July-07	
Direction Photo Taken: View to north within main working/stope.		
Description: Photo of woodrat midden.		

Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 21	Date: July-09		
Direction Photo Taken: View to south			
Description: Fill #1 borrow area.			

Photo No. 22	Date: July-09	
Direction Photo Taken: View to northwest.		
Description: Fill #2 borrow area.		

Client Name: United States Forest Service		Site Location: Kelly Camp Mine – Republic, Washington	Project No. 25697011
Photo No. 23	Date: July-09		
Direction Photo Taken: View to west.			
Description: Cow Camp borrow area.			

Photo No. 24	Date: July-09	
Direction Photo Taken: View to northwest.		
Description: Storm King borrow area.		

APPENDIX B
Applicable or Relevant and Appropriate Requirements

**Chemical-Specific
Applicable or Relevant and Appropriate Requirements
Kelly Camp Mine, Washington**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL			
Safe Drinking Water Act (SDWA)	40 USC § 300		
National Toxics Rule	40 CFR Part 131	Establishes water quality standards for protection of human health and aquatic organisms for states that fail to fully comply with Clean Water Act (CWA) Section 303(c)(2)(C).	Not Applicable—the State of Washington has been delegated this program. No surface water resources on or near the Site.
National Primary Drinking Water Regulations	40 CFR Part 141	Establishes health-based standards, maximum contaminant levels (MCL) and maximum contaminant level goals (MCLG), for public water systems.	Not Applicable or Relevant and Appropriate. No drinking water wells on or near the Site.
Clean Water Act (CWA)	33 USC §§ 1314		
National Recommended Water Quality Criteria (NWQC)	33 USC § 1251 et seq., Section 3 04(a), 40 CFR Part 131	Establishes non-enforceable criteria for water quality based on toxicity to aquatic organisms and human health.	Not Applicable—the State of Washington has been delegated this program. Recommended but not enforceable criteria. No surface water resources on or near the Site.
Clean Air Act (CAA)	40 USC § 7409		
National Primary and Secondary Ambient Air Quality Standards (NAAQS)	42 USC §§ 7401 et seq.	Establishes air quality levels that protect public health.	Not Applicable—only “major” sources are subject to requirements related to NAAQS, defer to state regulation of fugitive dust emissions.
Resource Conservation and Recovery Act (RCRA)	40 USC § 6901 6992k		
Hazardous Wastes	40 CFR Part 261, Subpart D and C	Defines those solids wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271.	Potentially Applicable or Relevant and Appropriate. Washington has not adopted the Bevill Amendment for mining waste. See action-specific ARARs for further discussion.
STATE OF WASHINGTON			
Hazardous Waste Removal Reduction Act	RCW Chapter 70.95C	Establishes state policies and goals that encourage the reduction of hazardous substance use and the generation of hazardous waste. Requires certain hazardous waste generators and hazardous substance users to prepare plans for voluntarily reducing hazardous substance use and hazardous waste generation.	Potentially Relevant and Appropriate
Persistent Bioaccumulative Toxins Rule	WAC Chapter 173-333	Establishes criteria to identify persistent bioaccumulative toxins that pose human health or environmental threats, defines chemical action plans preparation, and defines the processes ecology will use to coordinate the implementation of this chapter with the department of health and other agencies.	Potentially Relevant and Appropriate

**Chemical-Specific
Applicable or Relevant and Appropriate Requirements
Kelly Camp Mine, Washington**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
Surface Water Beneficial Uses	WAC Chapter 173-201A-200 and -600	Requires that surface water bodies be protected for their designated beneficial uses.	Not Applicable or Relevant and Appropriate. No surface water resources on or near the Site.
Dangerous Waste Regulations	WAC Chapter 173-303	(1) Designates solid wastes that are dangerous or extremely hazardous to the public health and environment; (2) provides for surveillance and monitoring of dangerous and extremely hazardous wastes; (3) establishes a system for manifesting, tracking, reporting, monitoring, recordkeeping, sampling, and labeling dangerous and extremely hazardous wastes; (4) establishes siting, design, operation, closure, postclosure, financial, and monitoring requirements for dangerous and extremely hazardous waste transfer, treatment, storage, and disposal facilities; (5) establishes design, operation, and monitoring requirements for managing the state's extremely hazardous waste disposal facility; (6) establishes a program for permitting dangerous and extremely hazardous waste management facilities; and (7) encourages recycling, reuse, reclamation, and recovery to the maximum extent possible.	Potentially Relevant and Appropriate
Drinking Water Standards	Revised Code of Washington (RCW) 70.1 19A, WAC Chapter 246-290	Established health-based MCLs for public water supplies.	Not Applicable or Relevant and Appropriate. No drinking water wells on or near the Site.
Water Quality Standards for Surface Water	RCW 90.48, WAC Chapter 173-201A	Establishes aquatic life criteria for hazardous substances in freshwater.	Not Applicable or Relevant and Appropriate. No surface water resources on or near the Site.
Model Toxics Control Act (MTCA)	RCW 70.1 05D, WAC Chapter 173-340	Specifies that surface water cleanup standards be based on estimates of the highest beneficial use and the reasonable maximum potential exposure under current and future site uses. Establishes administrative processes and standards to identify, investigate, and clean up facilities where hazardous substances have come to be located. It defines the role of the department and encourages public involvement in decision making.	Potentially Relevant and Appropriate
	WAC Chapter 173-340-7490	Specifies procedures for a Terrestrial Ecological Evaluation (TEE) to determine if the existence of hazardous substances at a site could harm terrestrial plants or animals, and to establish cleanup levels to protect biota.	Potentially Relevant and Appropriate
Natural Background Soil Metals Concentrations	WDOE Publication 94-115, October 1994	Defines region-specific natural background concentrations for metals in surficial soils throughout the state.	To Be Considered

**Chemical-Specific
Applicable or Relevant and Appropriate Requirements
Kelly Camp Mine, Washington**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
Sediment Management Standards	WAC 173-204	Establishes freshwater surface sediment management standards.	Not Relevant and Appropriate. Sediment management not part of the Removal Action scope.
Economic Impact Statement For Proposed Sediment Management Standards	WAC 173-204	The WDOE is proposing a management process for implementing sediment quality standards pursuant to requirements of the Model Toxics Control Act, the Water Pollution Control Act, and the Puget Sound Water Quality Authority Act.	Not Relevant and Appropriate. Sediment management not part of the Removal Action scope.

**Location-Specific
Applicable or Relevant and Appropriate Requirements
Kelly Camp Mine, Washington**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL			
RCRA	40 USC § 7601		
Hazardous and Solid Waste Regulations	40 CFR Part 264.18	Location standards and restrictions for hazardous waste treatment, storage, and disposal (TSD) facilities.	Potentially Relevant and Appropriate
	40 CFR §§ 257.3-1 through 257.3-4	Location standards and restrictions for municipal solid waste (MSW) facilities.	Potentially Relevant and Appropriate
Fish and Wildlife Coordination Act	16 USC §§ 661-667	Requires consultation with the USFWS when federal department or agency proposes or authorizes any modification of any stream or other water body to assure adequate protection of fish and wildlife resources.	Potentially Applicable
Fish and Wildlife Conservation Act	16 USC §§ 2901-2911	Promotes conservation of non-game fish and wildlife through assistance to states and use of federal authority.	Potentially Applicable
Protection of Wetlands Executive Order No. 11990	40 CFR Part 6; Appendix A, 40 CFR 6.302(a)	Established to avoid adverse impacts associated with the destruction or loss of wetlands and avoid support of new construction in wetlands if a practicable alternative exists.	Not Applicable. No surface water or wetland resources on or near the Site.
Floodplain Management Executive Order No. 11988	40 CFR Part 6, Appendix A, 40 CFR 6.302(b)	Requires federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid the adverse impacts associated with direct and indirect development of a floodplain to the extent possible.	Not Applicable. No floodplain on or near the Site.
Dredge and Fill Regulations	33 USC § 1344, 33 CFR 323.1 et seq.	Prohibits discharge of dredged or fill material into waters of the United States without a permit.	Not Applicable. No surface water resources on or near the Site. Dredging/filling not part of the Removal Action scope.
Bald Eagle Protection Act	16 USC §§ 668 et seq.	Requires continued consultation with the USFWS during remedial design and remedial construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald or golden eagle.	Potentially Applicable
Endangered Species Act (ESA)	16 USC § § 1531-1544	Outlines procedures for federal agencies to follow if actions may jeopardize listed species. Activities may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat.	Potentially Applicable
National Forest Management Act (NFMA), Colville National Forest Land and Resource Management Plan(LRMP, 1988), as amended by the Forest Service (1995)	16 USC § § 1600-1614	NFMA requires land management based on multiple-use, sustained-use yields. The LRMP and NWFP establish guidelines and standards for design, construction, and use of various actions on USFS land.	Potentially Applicable or Relevant and Appropriate

**Location-Specific
Applicable or Relevant and Appropriate Requirements
Kelly Camp Mine, Washington**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
National Historic Preservation Act (NHPA)	16 USC § 470; 36 CFR Part 800; 40 CFR 6.301(b)	Requires federal agencies to take into account the effect of any federally assisted undertaking or licensing on any property with historic, architectural, archeological, or cultural value that is included in or eligible for inclusion in the National Register of Historic Places.	Potentially Applicable
Archaeological Resources Protection Act	16 USC § 470	Specifies actions that must be taken to preserve archaeological resources.	Potentially Applicable
Archeological and Historic Preservation Act (AHPA)	16 USC § 469; 40 CFR 6.301(c)	Establishes procedures to provide for preservation of significant scientific, prehistoric, historic, and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	Potentially Applicable
Historic Site, Buildings, Objects, and Antiquities Act	16 USC § 461-467	Requires preservation of historic sites, buildings, and objects of national significance.	Potentially Applicable
Native American Graves Protection and Reparation Act	25 USC § 3001 et seq.	Establishes protective requirements to be followed when graves or Native American burial sites are encountered.	Potentially Applicable
The American Indian Religious Freedom Act (AIRFA)	42 USC § 1996	Requires federal agencies to protect the right of Indian tribes to practice their traditional religions.	Potentially Applicable
Wilderness Act	16 USC § § 1131-1136	Established the National Wilderness Preservation System, which concerns leaving lands unimpaired for future use as a wilderness.	Not Applicable. Site not within wilderness. No wilderness near the Site.

**Action-Specific
Applicable or Relevant and Appropriate Requirements
Kelly Camp Mine, Washington**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL			
Clean Water Act	33 USC § 1342		
National Pollutant Discharge Elimination System	40 CFR Part 122.26	In general, Part 122 provides permit requirements for the discharge of pollutants from any point source into waters of the United States. Part 122.26 requires permits for storm-water discharges.	Not Applicable. No surface water resources on or near the Site.
CWA – Water Pollution Control Act (WPCA), Water Quality Certification	33 USC § 1341, Section 401	Requires certification from the state (WDOE) that discharges into navigable waters comply with applicable water quality standards.	Not Applicable. No surface water resources on or near the Site.
CWA/WPCA – National Pollution Discharge Elimination System (NPDES)	33 USC § 1342, Section 402	Establishes requirements for point source discharges and stormwater runoff.	Not Applicable. No surface water resources on or near the Site.
CWA/WPCA – Discharge of Dredge and Fill Materials	33 USC § 1344, Section 404	Regulates the discharge of dredge and fill into waters of the United States, including wetlands.	Not Applicable. No surface water resources on or near the Site. Dredging or filling not part of the Removal Action scope.
Clean Air Act	42 USC § 7401 et seq., 40 CFR Part 50	Establishes limits for air emissions.	Potentially Applicable.
Land Disposal Restrictions (LDRs)	40 CFR Part 268	LDRs place specific restrictions (conc. or trmt) on RCRA hazardous wastes prior to their placement in a land disposal unit. Relevant and appropriate LDR requirements will be met if any material accumulations are treated ex situ.	Potentially Applicable.
RCRA Subtitle C – Hazardous Waste Management	42 USC § 6901, 40 CFR Parts 260 to 279	Specifies hazardous waste identification, management, and disposal requirements.	Potentially Applicable.
Subtitle D – Managing Municipal and Solid Waste	42 USC § 6901, 40 CFR Parts 257 and 258	Establishes guidelines for the management of non-hazardous solid waste.	Potentially Applicable.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TSD) Facilities	40 CFR Part 264.13.14	Requirements for proper handling, treatment, storage, and disposal of hazardous wastes.	Potentially Applicable.
Disposal of Solid Waste	42 U.S.C. § 6901 et seq; 40 CFR 257	Facility or practices in floodplains will not restrict flow of basic flood, reduce the temporary water storage capacity of the floodplain or otherwise result in a wash out of solid waste.	Potentially Applicable.

**Action-Specific
Applicable or Relevant and Appropriate Requirements
Kelly Camp Mine, Washington**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
Closure Requirements	RCRA/HWMA 40 CFR & 264, Subpart G	Closure of hazardous waste repositories must meet protective standards. Regulations to minimize contaminant migration, provide leachate collection and prevent contaminant exposure will be met.	Potentially Applicable.
Landfill Design and Construction	RCRA/HWMA 40 CFR & 264, Subpart N	Hazardous waste landfills must meet minimum design standards. Protectiveness will be achieved through capping and institutional controls.	Potentially Applicable.
Groundwater Monitoring	RCRA/HWMA 40 CFR & 264, Subpart F 40 CFR & 264, Subpart X	Establishes standards for detection and compliance monitoring. Site wide monitoring will accommodate specific groundwater monitoring requirements.	Not Applicable or Relevant and Appropriate. Monitoring groundwater is not part of the Removal Action scope.
Occupational Exposure to Asbestos	29 CFR Parts 1910 and 1926.	Establishes OSHA requirements for asbestos-related work in the construction and demolition industry. Requirements on exposure limits, work practices and engineering controls to provide worker safety in handling, removal, disposal, or other workplace exposure to asbestos.	Not applicable. Exposure to asbestos is unlikely during the Removal Action.
Superfund Remedial Design and Remedial Action Guidance	EPA OSWER Directive 9355.0-4A, June 1986	Provides guidance for site remediation and the design of remedial action components.	To Be Considered.
Hazardous Materials Transportation Act	49 USC § § 1801-1813 49 CFR Parts 10, 171-177	Regulates transportation of hazardous materials.	Potentially Applicable.
Surface Mining Control and Reclamation Act	30 USC §§ 1201-1328	Performance standards for surface mining activities.	Potentially Relevant and Appropriate.
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.	To Be Considered.
Protection and Enhancement of the Cultural Environment	Executive Order 11593	Directs federal agencies to nominate historic properties to the NRHP and treat properties that are eligible for the NRHP as though they were listed.	To Be Considered.
Invasive Species	Executive Order 13112	Requires federal agencies to prevent the introduction of invasive species.	To Be Considered.
Migratory Bird Treaty Act (MBTA)	16 USC § § 703 et seq.	Establishes federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds.	Potentially Relevant and Appropriate.

**Action-Specific
Applicable or Relevant and Appropriate Requirements
Kelly Camp Mine, Washington**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
Responsibilities of Federal Agencies to Protect Migratory Birds	Executive Order 13186	Requires federal agencies to avoid or minimize adverse impacts to migratory bird resources to the extent practical.	To Be Considered.
STATE OF WASHINGTON			
MTCA	RCW 70.1 05D, WAC Chapter 173-340	Establishes procedures and standards for investigating and cleaning up sites with hazardous substances present.	Potentially Applicable.
Sediment Management Standards	WAC 173-204	Establishes freshwater surface sediment management standards.	Not Relevant and Appropriate. Management of sediment is not part of the Removal Action scope.
Regulation and Licensing of Well Contractors and Operators	RCW 18.104, WAC Chapter 173-162	Establishes procedures for well contractors and operators.	Not Relevant and Appropriate. Use of well contractors and operators is not part of the Removal Action scope.
Minimum Standards for Construction and Maintenance of Water Wells	RCW 18.104, WAC Chapter 173-160	Sets minimum standards for the construction of water and monitoring wells, and well decommissioning.	Not Relevant and Appropriate. Well construction and maintenance is not part of the Removal Action scope.
Hazardous Waste Management Act and Dangerous Waste Regulations	RCW 70.105, WAC Chapter 173-303	Establishes regulations for the handling and deposition of dangerous waste, including identification, accumulation, storage, transport, treatment, and disposal.	Potentially Applicable – Washington has not adopted the Bevill Amendment for mining wastes.
Solids Waste Handling Standards	RCW 70.95, WAC Chapter 173-350	Establishes standards for the proper handling and disposal of solid waste, and requirements for the design, construction, operation, and closure of solid waste handling facilities.	Potentially Applicable or Relevant and Appropriate
Hydraulic Code	RCW 77.55, WAC Chapter 220-110	Requires a Hydraulics Project Approval permit for construction activities that use, divert, obstruct, or change the bed or flow of state waters.	Not Relevant and Appropriate. Activities affecting state waters is not part of the Removal Action scope.
Shoreline Management Act (SMA)	RCW 90.58	Established to prevent harm to the state's shorelines, including streams with a mean annual flow greater than 20 cubic feet per second.	Not Relevant and Appropriate. Activities affecting the state's shorelines is not part of the Removal Action scope.
Fugitive Dust Emissions	40 CFR Section 50.6	Establishes standards for PM-10	Potentially Applicable.
Water Quality Standards for Surface Waters – Mixing Zones	RCW 90.48, WAC Chapter 173-201A-400	Establishes mixing zone effluent limits for discharges to surface water.	Not Relevant and Appropriate. Discharges to surface waters are not part of the Removal Action scope.
Water Quality Standards for Surface Waters – Short-term Modifications	RCW 90.48, WAC Chapter 173-201A-410	Allows for short-term modification to water quality criteria for specific water bodies when necessary.	Not Relevant and Appropriate. Activities affecting surface waters are not part of the Removal Action scope.

**Action-Specific
Applicable or Relevant and Appropriate Requirements
Kelly Camp Mine, Washington**

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
Submission of Plans and Reports for Construction of Wastewater Treatment Facilities	RCW 90.48, WAC Chapter 173-240	Requires submission of wastewater treatment systems designs to the WDOE for review and approval.	Not Relevant and Appropriate. Wastewater treatment is not part of the Removal Action scope.
Aquatic Lands Management	RCW 79.90, WAC Chapter 332-30	Establishes criteria for the management of state-owned aquatic lands to promote uses and protect resources.	Not Relevant and Appropriate. Activities affecting aquatic lands are not part of the Removal Action scope.
Water Code and Regulation of Public Groundwater – Surface Water and Groundwater Withdrawal	RCW 90-90.03 and 90.44	Specify criteria and procedures for appropriating surface water and groundwater for beneficial uses.	Not Relevant and Appropriate. Surface water and groundwater withdrawals are not part of the Removal Action scope.
Maximum Environmental Noise Levels	RCW-70. 107, WAC Chapter 173-60	Establishes maximum permissible noise levels.	Potentially Applicable
Washington Clean Air Act and Implementing Regulations	WAC Chapter 173-400-040(8)	Requires reasonable precautions be taken to prevent the generation of fugitive dust.	Potentially Relevant and Appropriate
General Regulations for Air Pollution Sources	RCW 70.94, WAC Chapter 173-400	Regulates air pollution from contaminant sources, and establishes rules for the control and prevention of air contaminant emissions.	Potentially Applicable

APPENDIX C
Removal Action Construction Cost Estimate

**US Forest Service
Kelly Camp Mine
Removal Action Construction Cost Estimate**

Item	Description	Unit	Unit Rate	Quantity	Cost	Assumptions
Alternative 2 - Consolidation and Onsite Capping						
1	Erosion & Sediment Control	LF	\$ 2.27	1,345	\$ 3,053	Silt fence entire site perimeter
2	Decontamination Station (supply, maintain, dispose)	LS	\$ 2,500.00	1	\$ 2,500	
3	Clearing, Grubbing & Minor Site Access Improvements	AC	\$ 5,700.00	0.41	\$ 2,362	LWRP & UWRP
4	Waste Rock Excavation, Haul & Stockpile	CY	\$ 5.17	187	\$ 967	20 CY dump, 1 mile RT, Includes 20% increase in volume for overexcavation
5	Grade & Compact Waste Rock	CY	\$ 3.75	187	\$ 702	Dozer, 2 passes with vibratory roller
6	Borrow Excavation, Screen, Haul & Stockpile	CY	\$ 8.00	900	\$ 7,200	20 CY dump, 4 mile RT, screen as you load (no mechanized screening)
7	Grade & Compact Borrow	CY	\$ 3.75	900	\$ 3,375	Dozer, 2 passes with vibratory roller
8	Compost (delivered & placed to 6" thick, nom. compaction)	CY	\$ 77.51	440	\$ 34,105	Cost from previous Beth Lake project, Place on LWRP & UWRP
9	Seed (USFS seed mix, push spreader)	SF	\$ 0.06	18,050	\$ 1,056	LWRP & UWRP
10	Placement of Onsite Woody Debris	LS	\$ 1,000.00	1	\$ 1,000	LWRP & UWRP
11	Grade Test Pits (7)	LS	\$ 500.00	1	\$ 500	
12	Fill East Openings 1 & 2 with Blast Rock	LS	\$ 1,000.00	1	\$ 1,000	Minor road clearing, excavation, haul & place (excavator) large boulders within openings, surround with cobbles, grade to surface
13	Bat Gates (3)	LS	\$22,000.00	1	\$ 22,000	2 @ \$8,000 each for upper, 1 @ \$6,000 for lower (Rodney Lentz email)
14	O&M (with monitoring)	LS	\$ 11,500.00	1	\$ 11,500	2, 10 hr visits/year for 5 years, including herbicide, minor weed removal, disposal on site, and small quantity reseeding by hand
Subtotal =					\$ 91,320	
Mobilization/Demobilization				15%	\$ 13,698	Site location, limited lodging, eating and equipment rental options
Contingency				20%	\$ 21,004	
Total, Alternative 2 =					\$ 126,022	
Alternative 3 - Excavation and Offsite Disposal						
1	Erosion & Sediment Control	LF	\$ 2.27	1,345	\$ 3,053	Silt fence entire site perimeter
2	Decontamination Station (supply, maintain, dispose)	LS	\$ 2,500.00	1	\$ 2,500	
3	Clearing, Grubbing & Minor Site Access Improvements	AC	\$ 5,700.00	0.41	\$ 2,362	LWRP & UWRP
4	Waste Rock Excavation, Load, Haul & Stockpile	CY	\$ 5.17	652	\$ 3,367	20 CY dump, 1 mile RT, LWRP & UWRP. Includes 20% increase in volume for overexcavation
5	Waste Rock Disposal (load & haul)	HR	\$ 120.00	529	\$ 63,531	16 CY Truck, 10 hrs RT to Grahm Road LF, No backhaul, 1.3 bulking factor
6	Waste Rock Disposal (tipping fees)	TN	\$ 30.00	1,056	\$ 31,668	16 CY Truck, Grahm Road LF, WR unit weight = 120 PCF
7	Compost (delivered & placed to 6" thick, nom. compaction)	CY	\$ 77.51	440	\$ 34,105	Cost from previous Beth Lake project, Place on LWRP & UWRP
8	Seed (USFS seed mix, push spreader)	SF	\$ 0.06	18,050	\$ 1,056	LWRP & UWRP
9	Placement of Onsite Woody Debris	LS	\$ 1,000.00	1	\$ 1,000	LWRP & UWRP
10	Grade Test Pits (7)	LS	\$ 500.00	1	\$ 500	
11	Fill East Openings 1 & 2 with Waste Rock	LS	\$ 2,000.00	1	\$ 2,000	Minor road clearing, excavation, haul (truck) & place (excavator). Assume 40 CY of Waste Rock. Top with blast rock to surface
12	Bat Gates (3)	LS	\$22,000.00	1	\$ 22,000	2 @ \$8,000 each for upper, 1 @ \$6,000 for lower (Rodney Lentz email)
13	O&M (with monitoring)	LS	\$ 11,500.00	1	\$ 11,500	2, 10 hr visits/year for 5 years, including herbicide, minor weed removal, disposal on site, and small quantity reseeding by hand
Subtotal =					\$ 178,641	
Mobilization/Demobilization				10%	\$ 17,864	Site location, less onsite equipment, limited lodging, eating and equipment rental options
Contingency				20%	\$ 39,301	
Total, Alternative 3 =					\$ 235,807	
General Assumptions						
1	Contractor to comply with all substantive permit requirements, however no permitting costs are anticipated or included.					
2	No additional waste rock testing is included.					
3	Unit rate for compost determined from average cost for Beth Lake project.					
4	Mobilization/demobilization percentage was adjusted to account for remote site location.					
5	Backhaul of compost not included in Alternative 3. A reduction for backhaul of compost would result in a cost savings.					
6	Waste rock will be accepted at Grahm Road Landfill and no additional testing is required.					
7	Dump truck access to East Openings 1 & 2 with minimal clearing and grubbing for Alternative 3. 40 CY of WR will sufficiently fill adit.					
8	No price escalation included.					