Engineering Evaluation/Cost Analysis for the Non-Time-Critical Removal Action at the Altaville Mining District, Mammoth Mine Six Rivers National Forest, Del Norte County, California

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Executive Summary

Engineering/Remediation Resources Group, Inc., has prepared this Engineering Evaluation/Cost Analysis (EE/CA) report for the U.S. Department of Agriculture Forest Service (Forest Service) for Mammoth Mine (hereinafter referred to as the "area of contamination" [AOC]), within the Altaville Mining District in Del Norte County, California. The AOC is an abandoned copper and chromite mine in the north half of Section 35, Township 18 North, Range 1 East, of the Humboldt Meridian within the Six Rivers National Forest (Figure 1). The purpose of the EE/CA was to develop and analyze removal action alternatives to aid the Forest Service in reclamation of the AOC.

Based on the results of previous investigations in 2009 and 2012, as well as for additional samples collected as part of this EE/CA, metals in waste rock at the AOC pose an unacceptable risk to human health and the environment. Therefore, a removal action is necessary to reduce the risks posed human and ecological health associated with metals at the AOC.

The following preliminary removal action objectives (RAOs) were developed to reduce the risks to humans and wildlife at the AOC:

- Reduce exposure of humans and wildlife to the waste rock piles, which contain metals at concentrations exceeding human health and ecological screening criteria
  - Reduce the risk of erosion of waste rock into surface waterways as sediment

Removal action alternatives were then developed and evaluated to select a preferred remedy that would meet the RAOs. This EE/CA evaluates the following removal action alternatives to address the RAOs:

1. Alternative 1: No Action
2. Alternative 2: Removal and Onsite Encapsulation (at the AOC)
3. Alternative 3: Removal and Onsite Encapsulation (within the Altaville Mining District, near the AOC)
4. Alternative 4: Removal and Offsite Disposal

Each alternative was analyzed for effectiveness, implementability, and cost. After the analysis of alternatives, a comparative analysis of all the alternatives was conducted and the recommended removal action alternative was selected. Based on the detailed and comparative analyses, **Alternative 2, Removal and Onsite Encapsulation (at the AOC),** is recommended as the preferred remedy for the AOC. Alternative 2 is recommended because it would (1) achieve the RAOs, (2) meet the applicable or relevant

and appropriate requirements, and (3) be more cost-effective than the other alternatives except for Alternative 1 (no action).

The recommended removal action alternative has the primary components summarized below.

- A long-reach large excavator would excavate mine waste rock. A tracked dump truck would move the mine waste from the rock piles to the repository. A bulldozer would grade the repository. An excavator would also be used at the repository area to load trucks with clean cap soil and to place the source materials and clean cap soil. Two water trailers would be required for fire control and dust suppression.
- A 4,400-square-foot demarcation layer would be placed 1 foot below the top of the soil cap.
- An estimated 424 cubic yards of clean soil would be required to construct the soil cap. It is assumed that this material would be available from an onsite source. The potential onsite source would require testing before use to ensure that the material is suitable for use as clean fill. If an appropriate onsite backfill source is not located, the cost of implementation would increase to account for the import of backfill from off site.
- Botanical oversight would be conducted to ensure that sensitive plant species are not harmed during construction.
- Waste removal would be confirmed by visual assessment only; costs for confirmation sampling and analysis are not included.
- Approximately 6,200 square feet of disturbed waste removal areas would be restored to a natural grade and would have best management practices installed.
- Annual inspections would be conducted to evaluate the integrity of all cover elements and erosion control measures.

The estimated total capital cost for implementing the recommended removal action alternative is $673,000. The long-term total cost for implementing this alternative is $699,400, with a present value cost of $696,500. This cost represents an order-of-magnitude estimate in accordance with the U.S. Environmental Protection Agency's guidance for conducting EE/CAs, with an intended accuracy of +50 to -30 percent.

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Abbreviations and Acronyms

§	Section
AOC	area of contamination
ARARs	applicable or relevant and appropriate requirements
Basin Plan	"Water Quality Control Plan for the North Coast Region"
BLM	Bureau of Land Management
BMPs	best management practices
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	chemicals of concern
COPCs	chemicals of potential concern
cy	cubic yards
Eco-SSL	ecological soil screening level
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
ERRG	Engineering/Remediation Resources Group, Inc.
Forest Service	U.S. Department of Agriculture Forest Service
GPS	global positioning system
mg/kg	milligrams per kilogram
Micro	Micro Analytical Laboratories, Inc.
NAWQCs	National Ambient Water Quality Criteria
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
NTCRA	non-time-critical removal action
O&M	operation and maintenance

Abbreviations and Acronyms *(continued)*

PA/SI	Preliminary Assessment/Site Inspection
PRP	potentially responsible party
RAOs	removal action objectives
RCRA	Resource Conservation and Recovery Act
RMC	risk management criteria
RSL	regional screening level
SCEM	site conceptual exposure model
SPLP	synthetic precipitation leaching procedure
SRE	streamlined risk evaluation
SWRCB	State Water Resources Control Board
TBC	to be considered
TCLP	toxic characteristic leaching procedure
TELs	threshold effect levels
TestAmerica	TestAmerica Laboratories, Inc.
TLI	TLI Solutions, Inc.
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USC	*United States Code*
Water Board	North Coast Regional Water Quality Control Board
WET	waste extraction test
WRCC	Western Regional Climate Center

Section 1. Introduction

Engineering/Remediation Resources Group, Inc. (ERRG), has prepared this Engineering Evaluation/Cost Analysis (EE/CA) report for the U.S. Department of Agriculture (USDA) Forest Service (Forest Service) for the Mammoth Mine (hereinafter referred to as the "area of contamination" [AOC]) within the Altaville Mining District in the Six Rivers National Forest, Del Norte County, California. This work was conducted under the Regional A/E Indefinite Quantity Contract for Environmental Site Response Activities (AG91S8-C-11-0001), Activity II, Task 2: EE/CA Support and in accordance with the "Work Plan for Engineering Evaluation/Cost Analyses, Non-Time-Critical Removal Actions, Mammoth and Hardscrabble Mine Sites, Six Rivers National Forest, Del Norte County, California" (ERRG, 2013b).

In 2012, a Preliminary Assessment/Site Inspection (PA/SI) was conducted at the AOC that recommended further action to address potential risks posed to humans and wildlife from elevated concentrations of metals in mine waste (ERRG, 2012). This EE/CA was prepared as part of the non-time-critical removal action (NTCRA) process under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The following subsections discuss the regulatory framework for the AOC, the purpose of the EE/CA, and the organization of this report.

1.1. REGULATORY FRAMEWORK

Authority for responding to releases from a hazardous waste site is addressed in Section 104 of CERCLA. Executive Order 12580 delegates the authority for removal actions to the USDA. The Forest Service, under the delegation of USDA's authority, is the lead federal agency for environmental investigation and cleanup of the AOC and as such oversees all project activities. Other federal, state, or local agency representatives may be consulted at the discretion of the Forest Service. The Forest Service will ensure that all removal action activities comply with CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and Division 20, Chapter 6.8, of the State of California Health and Safety Code.

The U.S. Environmental Protection Agency (EPA) has classified removal actions into three types: emergency, time-critical, and non-time critical. The classification is based on the type of situation, the urgency to take action, the threat of release or potential release, and the period of time in which the action must be initiated (EPA, 1993). An NTCRA was selected for this AOC because no immediate threat is posed to human health or the environment from onsite contaminants. Therefore, the NTCRA can start later than 6 months after the determination that a response is necessary. Section 300.415(b)(4)(i) of the NCP requires that an EE/CA is prepared for all NTCRAs to evaluate removal action alternatives.

1.2. PURPOSE

The purpose of the EE/CA is to develop and analyze removal action alternatives in accordance with CERCLA and to recommend a removal action alternative that is protective of human health and the environment and compliant with federal and state applicable or relevant and appropriate requirements (ARARs). In accordance with EPA guidance, the EE/CA is completed to (1) meet the environmental review requirements for removal actions; (2) satisfy administrative record requirements for documentation of removal action selection; and (3) identify the objectives of a removal action and analyze the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives (EPA, 1993).

1.3. REPORT ORGANIZATION

After Section 1, this EE/CA has the following sections:

- Section 2, Site Characterization – summarizes the Mammoth AOC description and background; describes the physical characteristics of the AOC; and summarizes the source, nature, and extent of contamination based on previous investigations at the AOC
- Section 3, Streamlined Risk Evaluation – discusses the selection and screening of chemicals of potential concern (COPCs) and summarizes the site conceptual exposure model (SCEM) and the results of the screening evaluation of risks to human health and the environment at the AOC
- Section 4, Removal Action Goals and Objectives – identifies the removal action goals and removal action objectives (RAOs) that, if met, will result in the protection of human health and the environment compliant with CERCLA criteria
- Section 5, Applicable or Relevant and Appropriate Requirements – lists and details chemical-specific, location-specific, and action-specific ARARs that aid in establishing cleanup criteria for the AOC
- Section 6, Identification and Analysis of Removal Action Alternatives – describes the identification of removal action alternatives, and analyzes each alternative for effectiveness, implementability, and cost
- Section 7, Comparative Analysis of and Recommended Removal Action Alternatives – provides a comparative analysis of the removal action alternatives, and presents the recommended removal action alternative for the AOC
- Section 8, References – lists the reports, literature, and guidance documents used to prepare this EE/CA report

Figures and tables are provided after Section 8. In addition, the EE/CA provides the following appendices and attachments of supplemental information:

- Appendix A - Photographic Log
- Appendix B - Field Activity Logs
- Appendix C - Laboratory Analytical Reports
- Appendix D - Altaville Mining District Background Metals Evaluation

- Appendix E - Removal Action Cost Estimate
- Attachment 1 – Copper Creek 2012 Level II Stream Survey
- Attachment 2 - Riparian Management Standards and Statutes for Copper Creek CERCLA Mine Tailing Abatement

Section 2. Site Characterization

This section describes the AOC and its background; physical characteristics; and the source, nature, and extent of contamination based on the results of previous environmental investigations. This section provides the basis for understanding the COPCs and media of potential concern at the AOC.

2.1. AOC DESCRIPTION AND BACKGROUND

The AOC (i.e., Mammoth Mine) is located within the Altaville Mining District, which is a CERCLA site. The Altaville Mining District encompasses approximately 50 square miles and is bounded by the Six Rivers National Forest and Smith River National Recreation Area to the west, the forest and the Oregon State line to the north, the North Fork of the Smith River to the east, and the Smith River to the south (Figure 1). The AOC is an abandoned copper and chromite mine in the north half of Section 35, Township 18 North, Range 1 East, of the Humboldt Meridian within the Six Rivers National Forest in Del Norte County, California.

The AOC is accessible on foot through a former mine road from County Route 305 (Figure 1). The AOC is approximately 20 miles northeast of Crescent City, California, and 9 miles east of the town of Smith River by road.

Figure 2 shows the AOC features. An unnamed tributary to Copper Creek flows westward through the AOC. Four former mine adits, each with an associated waste rock pile, have been identified at the AOC. Three adits with associated waste rock piles are located on the southern bank of the unnamed tributary, and one adit with an associated waste rock pile is located on the northern bank. The three adit openings on the south side of the tributary have been secured with bat gates and are not currently a safety hazard. Other AOC features include a former loading area and a former ore chute. The largest waste rock pile (Waste Rock Pile 1) is in direct contact with the unnamed tributary. A dirt and gravel trail (likely a former mine road) leads from Copper Creek to the AOC along the southern bank of the tributary and crosses the tributary to the northernmost adit and Waste Rock Pile 4.

The history and land use and populations of the AOC are discussed below.

2.1.1. AOC History

The AOC is located within the Altaville Mining District (Figure 1). In 1853, copper and chromite deposits were discovered at the head of Copper Creek. In 1860, the mining camp of Altaville was established in the vicinity of the AOC. Altaville's population increased as more mines opened after rising copper prices in response to the needs of the Civil War. By 1863, 25 different mining companies were in operation in the Alta Mining District. Mining was most active in the area between 1860 and 1863, although more limited

activity took place on and off until 1920, when mining activity in Del Norte County was limited to assessment and exploration work rather than active mining (TLI Solutions, Inc. [TLI], 2012).

The AOC currently is owned by the Forest Service, and the land is managed as part of the Six Rivers National Forest. A number of parties have held claims on the mineral rights at the AOC since the start of operations, but no viable responsible parties have been identified (TLI, 2012).

2.1.2. Land Use and Populations

The AOC is located in a remote area of the Six Rivers National Forest. The area surrounding the AOC is open space used only for recreation. The AOC is located within the Smith River National Recreation Area, where the land is used for recreational purposes, including all-terrain vehicle usage, camping, fishing, and kayaking (Forest Service, 2013).

The AOC may be occasionally used for recreational purposes. However, little evidence of recent human activity at the AOC (such as trash or campfires) was observed during the 2013 site visit and during previous site visits (ERRG, 2012). In 2008, during a removal action implemented at the nearby Union-Zaar Mine, the access road to the AOC was blocked with large boulders to prevent vehicular access (ERRG, 2009a). However, it was noted during the 2013 site visit that one of the boulders had been displaced enough to allow a small vehicle through. During the EE/CA site visit, wheel tracks were visible along the road to the AOC's former ore loading area, but no evidence of recent visitation was observed at the AOC. The future use of the AOC will remain as public open space for recreation.

2.2. PHYSICAL CHARACTERISTICS

This section describes the physical characteristics of the AOC, including its climate, geology and soil, hydrology and hydrogeology, ecology, and cultural resources.

2.2.1. Climate

The weather station at the Gasquet Ranger Station in Gasquet, California, provides the most representative long-term climate data for the AOC area. Annual precipitation in the AOC area exceeds 90 inches per year, with an average of at least 12 inches per month between November and March. The average annual precipitation recorded at the Gasquet Ranger Station for the period from 1948 to 2013 was 93.36 inches, with more than 90 percent of the annual precipitation occurring between October and April. Precipitation in the area mainly consists of rainfall, but the Gasquet Ranger Station weather station reports approximately 2 inches of snowfall annually (Western Regional Climate Center [WRCC], 2013).

2.2.2. Geology and Soil

The AOC is located at the western boundary of the Klamath Mountains geomorphic province in Del Norte County, California (ERRG, 2012). The Klamath province is characterized by a series of accreted terrains,

primarily of Mesozoic age, with peaks reaching 6,000 to 8,000 feet above sea level. These terrains include several discrete ophiolite complexes, punctuated by granitic plutons. Sandstone and shale with intercalated volcanic rock are present in the western Klamath province where the AOC is located (Norris and Webb, 1990). The Klamath Mountain ophiolite suite includes ultramafic mineralized serpentinite members, which are the source for copper, chromium, and iron ore in the Altaville area (TLI, 2012). Naturally occurring chrysotile asbestos is a common mineral form of the serpentine minerals that comprise serpentinite in the AOC area (The American Geological Institute, 1984).

Two soil groups are present at the AOC: the Lithic Haploxeralfs-ultramafic/Walnett family with deep stony association and the Jayel/moderately deep-Walnett family with deep lithic Xerocherpts and a stony ultramafic association. All of these soil groups form on mountain slopes from weathered serpentinite bedrock and are well drained. Each group consists of two or more subgroups with similar soil families (USDA Natural Resources Conservation Service [NRCS], 2014).

Lithic Haploxeralfs-ultramafic forms on slopes from 35 to 70 percent, with a thickness of 19 to 23 inches, and is well drained. The Walnett family with deep stony association forms on slopes from 25 to 70 percent, with a thickness of 60 to 64 inches. The Jayel/moderately deep-Walnett family forms on slopes of 35 to 60 percent, with a thickness on 31 to 35 inches. Lithic Xerocherpts and a stony ultramafic association forms on slopes from 35 to 75 percent, with a thickness of 19 to 23 inches. The specific soil profile for each family is different but most ranges from stony clay to loam (NRCS, 2014).

2.2.3. Hydrology and Hydrogeology

The AOC is located approximately 9 miles east of the Pacific Ocean coastline within the northeast region of the Klamath Mountains. Elevations range from 1,300 to 1,700 feet above mean sea level. The AOC is characterized by steep slopes and a narrow drainage (the unnamed tributary to Copper Creek). Most mining activities at the AOC were conducted along a south-to-southeast-trending ridgeline (Figure 2). The unnamed tributary drains into Copper Creek, which drains into Rowdy Creek, a tributary to the Smith River that ultimately flows into the Pacific Ocean. The unnamed tributary is approximately 15.6 miles upstream from the ocean. The AOC is not located within a mapped floodplain (References).

The AOC is located within the Rowdy Creek hydrologic subarea of the Smith River hydrologic unit, designated as 103.12 in the "Water Quality Control Plan for the North Coast Region" (Basin Plan) (North Coast Regional Water Quality Control Board [Water Board], 2011). The Rowdy Creek hydrologic subarea has been identified as a cold freshwater habitat. Surface waters within the Rowdy Creek hydrologic subarea have been designated for the following existing beneficial uses:

- Municipal and Domestic Supply
- Agricultural Supply
- Industrial Service Supply

- Freshwater Replenishment
- Navigation
- Recreation (water contact and non-water contact)
- Commercial and Sport Fishing
- Cold Freshwater Habitat
- Wildlife Habitat (including marine habitat, estuarine habitat, and spawning habitat and habitat for rare, threatened, or endangered species)
- Migration of Aquatic Organisms
- Native American Cultural Uses

And the following potential future uses:

- Industrial Process Supply
- Hydropower Generation
- Aquaculture

The State Water Resources Control Board (SWRCB) currently has nine permits on file for diversion of surface water within 15 miles downstream of the AOC (SWRCB, 2014). The California Department of Fish and Wildlife (CDFW) issues permits for modification of the streambed and diversion of surface water. The CDFW currently has one permit on file for modification of the streambed and diversion of surface water within 15 miles downstream of the AOC. This permit (for the Rowdy Creek Fish Hatchery) is currently on hold (CDFW, 2014b). It is likely that unpermitted diversion of surface water is also taking place in the community of Smith River (CDFW, 2014a). Three domestic groundwater wells and groundwater monitoring wells are located within a 4-mile radius of the AOC. Table 1 summarizes the well locations. The static groundwater levels recorded for wells within the AOC area are 12 and 29 feet below ground surface (SWRCB, 2012a). No groundwater data are available for the area directly beneath the AOC, but it is likely that groundwater beneath the AOC generally follows the topography (ERRG, 2012).

2.2.4. Ecology

A number of sensitive environments exist at the AOC and downstream from the AOC. During surveys in the 1980s, the CDFW identified Copper Creek as "anadromous fish habitat," with a habitat suitability rating of "very high" (CDFW, 2011). In 1972, Steelhead trout (*Oncorhynchus mykiss*), Chinook salmon (*Oncorhynchus tshawytscha*), and Coho salmon (*Oncorhynchus kisutch*) fingerlings were present in the upper reaches of Copper Creek. In addition, the National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Service included Copper Creek in its compilation of streams for which historical records exist (up to the year 2000) documenting the occurrence of Coho salmon (ERRG, 2012; Dames and Moore, 1985). The Forest Service conducts stream surveys on a regular basis, most recently in

2012. Steelhead trout, Cutthroat trout (*Oncorhynchus clarki clarki*), and two unknown salmonids were identified in Copper Creek during the 2012 survey. Attachment 1 includes the most recent stream survey for Copper Creek.

Sensitive environments within a 4-mile radius of the AOC include habitat known to be used by McDonald's Rock Cress (*Arabis macdonaldiana*), Coho salmon, Cutthroat trout, and Steelhead trout. Copper Creek may serve as habitat for species documented in adjacent areas, including the Mardon Skipper (*Polites mardon*) and Oregon Silverspot Butterfly (*Speyeria zerene hippolyta*) (CDFW, 2011).

The following sensitive environments were identified during the PA/SI within the 15-mile target distance limit (EPA, 1991) downstream of the AOC: (1) a 3-mile stretch of the Smith River federally designated as a National Wild and Scenic River and (2) habitats known to be used by the Bald Eagle (*Haliaeetus leucocephalus*), Bank Swallow (*Riparia riparia*), Tidewater Goby (*Eucyclogobius newberryi*), Western Snowy Plover (*Charadrius alexandrinus nivosus*), and other special-status species (ERRG, 2012). Table 2 is a complete list of special-status animal species potentially present within a 4-mile-radius or 15 miles downstream of the AOC. Table 3 is a complete list of special-status plant species potentially present within a 4-mile-radius or 15 miles downstream of the AOC.

No wetland surveys have been conducted at the AOC; however, it is possible that areas of the AOC along the tributary and areas downstream of the AOC along Copper Creek may constitute wetland habitat. California pitcher plant (*Darlingtonia californica*) is present throughout the Altaville Mining District and has been observed in areas surrounding the AOC. This plant is considered a wetland indicator (Lichvar, 2013).

Section 404 of the Clean Water Act, defines wetlands as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas…" (33 *United States Code* [USC] 1251—1387). The U.S. Army Corps of Engineers (USACE) has developed guidelines and methods to determine whether an area is a wetland under Section 404 (USACE, 1987). The SWRCB (2012b) further defines a wetland as:

- an area that is covered by shallow water or where the surface soil is saturated, either year-round or during periods of the year;
- where that water coverage has caused a lack of oxygen in the surface soil; and
- has either no vegetation or plants of a type that have adapted to shallow water or saturated soil. Some examples are freshwater marshes, bogs, riparian areas, vernal pools, coastal mud flats, and salt marshes.

Further study and delineation by an appropriately certified biologist would be required to establish whether sensitive wetland habitat is present at or downstream of the AOC.

2.2.5. Cultural Resources

In 2011, archival research and an archaeological survey were conducted for the Low Divide Mining District (a subset of the Altaville Mining District, near the intersection of County Road 305 and Forest Road 17N49), which includes the AOC. Based on the research and survey results, it was determined that cultural resources may be present at the AOC. Additionally, mining adits and shafts associated within the Low Divide Mining District qualified to be listed as historic places under the "Preliminary Determination of Eligibility for the National Register of Historic Places" (Keter, 2011).

Surface waters within the Rowdy Creek hydrologic subarea, which includes the AOC, have been designated for "Native American Cultural Uses" in the "Water Quality Control Plan for the North Coast Region" (see Section 2.2.3; Water Board, 2011).

2.3. SOURCE, NATURE, AND EXTENT OF CONTAMINATION

This section summarizes the source, nature, and extent of contamination at the AOC based on analytical data collected during previous investigations at the AOC as well as during a 2013 sampling event conducted as part of this EE/CA. This section also summarizes the results of the investigations and relevant data from the investigation areas that are further evaluated in the streamlined risk evaluation (SRE) in Section 3. Four previous investigations have been conducted at the AOC: a preliminary mine study in 2009 (ERRG, 2009b), a PA/SI in 2011 and 2012 (ERRG, 2012), a potentially responsible party (PRP) search in 2012 (TLI, 2012), and EE/CA sampling in 2013.

2.3.1. Preliminary Mine Study (2009)

In 2009, ERRG performed a preliminary mine study of numerous inactive and abandoned mines in the Altaville Mining District for the Forest Service, including the AOC (known as Site 400 during the preliminary survey) (ERRG, 2009b). The mines were evaluated to prioritize response actions based on the potential for exposure of humans or wildlife to hazardous conditions, including both physical hazards (such as open mine adits and shafts) and chemical hazards (such as mine waste impacting surface water sources).

The survey included collection and analysis of a sample from the largest waste rock pile (Waste Rock Pile 1) at the AOC, which was observed to be eroding into the unnamed tributary. In addition, a water sample was collected from the associated adit. Figure 3 shows the sample locations from the 2009 survey. Screening results for the waste rock sample indicated arsenic, chromium, copper, and mercury were present at concentrations exceeding regional background concentrations and ecological screening criteria, indicating a potential risk to the environment. Cadmium results also exceeded ecological screening criteria. However, no regional background concentrations were available for comparison. Of these metals, only

copper concentrations exceeded the criterion for soil and waste rock that is protective of human health (U.S. Department of the Interior Bureau of Land Management [BLM] camper risk management criteria [RMC]). Screening results for the surface water sample indicated copper at concentrations exceeding the EPA freshwater aquatic life protection criterion of 11 milligrams per liter. The AOC was prioritized for further investigation based on the elevated metals concentrations in Waste Rock Pile 1 and the fact that waste from this pile was eroding into the unnamed tributary.

2.3.2. PA/SI (2011–2012)

During the PA/SI, four waste rock piles were identified at the AOC on the steep slopes above the unnamed tributary to Copper Creek (Figure 2; ERRG, 2012). Samples were collected from each pile, as well as from surface water and sediment in the unnamed tributary. Figure 3 shows the sample locations from the PA/SI. Table 4 summarizes waste rock sample results for metals from the PA/SI.

A background sample was collected upgradient of the AOC, where no evidence of mining operations was observed (Figure 3). Upstream surface water and sediment samples were also collected upgradient of the AOC. Results of background samples from near the AOC and upstream samples were used during the PA/SI for screening purposes.

Results for samples from three of the piles (Waste Rock Piles 1, 2, and 3 on Figure 3) indicated elevated concentrations of arsenic and copper. The largest pile had eroded downslope and was documented as being in direct contact with the unnamed tributary. Tables 5 and 6, respectively, summarize the sediment and surface water sample results for metals. No significant metals concentrations or pH impacts in surface water were noted. However, the PA/SI report noted that seasonal changes could create more drainage and erosion of waste rock into the tributary, which could directly impact sediment in the creek and adversely affect spawning habitat.

Preliminary leachability results for waste rock, analyzed by the waste extraction test (WET), indicated that copper may be leaching from the waste material. The WET, however, is intended to evaluate waste in a landfill environment, rather than under natural precipitation conditions. As a result, the PA/SI report recommended additional leachability testing representative of natural precipitation conditions be performed. Table 7 presents the WET results.

The exposure pathways summarized below were noted to be of potential concern.

- Dermal contact or ingestion of waste rock by AOC visitors or wildlife: Humans and wildlife may come into direct contact with impacted waste materials at the AOC.
- Dermal contact or ingestion of surface water or sediment in the unnamed tributary to Copper Creek by AOC visitors or wildlife: Humans and wildlife may come into direct contact with surface water or sediment into which contaminated soil has eroded or leached.

- Dermal contact or ingestion of groundwater: Humans may come into direct contact with groundwater into which contaminated soil has leached. Domestic groundwater wells are present within 4 miles of the AOC.

The PA/SI report recommended further action at the AOC to protect Basin Plan beneficial uses, especially cold water, wildlife, and downstream habitat that supports sensitive species, and to protect groundwater from potentially leaching metals.

2.3.3. Potentially Responsible Party Search, 2012

TLI Solutions conducted a PRP search in 2012 (TLI, 2012). The intent of the search was to identify any parties who may bear some financial responsibility for AOC investigation and cleanup. The PRP search consisted of research into the various companies and individuals who held mining claims over the years and who conducted mining operations at the AOC. The PRP report concluded that PRPs may exist and recommended further research to determine whether they are viable.

2.3.4. EE/CA Sampling, 2013

Based on the recommendations in the PA/SI report, ERRG conducted site reconnaissance and collected additional leachability samples to further evaluate risk posed to humans and wildlife from waste rock piles at the AOC in accordance with the work plan (ERRG, 2013b). Appendix A presents a photographic log of the AOC during the 2013 sampling event, and Appendix B presents the field logs. ERRG surveyed the AOC using a handheld Trimble Geo XH global positioning system (GPS) to refine the waste volume estimates from the PA/SI report and confirm the locations of AOC features.

The only change noted to AOC features originally identified in the PA/SI report was that the Forest Service had secured three open or partially collapsed adits on the south side of the tributary since the PA/SI. It was also noted during the fieldwork for this EE/CA that one of the large boulders previously blocking the access road to the AOC had been moved.

The three waste rock piles identified in the PA/SI were mapped using GPS. The perimeter of each pile was mapped in addition to several transects across each pile. These data were used to create a topographical projection of each waste pile and estimate its volume. Waste Rock Pile 1 is estimated to contain approximately 300 cubic yards (cy), Waste Rock Pile 2 contains approximately 20 cy, and Waste Rock Pile 3 contains approximately 35 cy. An additional 10 cy is estimated to be eroding down the slope from the toe of Waste Rock Pile 1 into Copper Creek.

One composite waste rock pile sample was collected from each of the three piles previously identified as containing elevated metals concentrations. Figure 3 shows the sample locations at Waste Rock Piles 1, 2, and 3. Appendix C provides the complete laboratory analytical report. The samples were analyzed for leachability under natural precipitation conditions using the synthetic precipitation leaching procedure

(SPLP) and the toxic characteristic leaching procedure (TCLP) for waste characterization. Table 7 summarizes the leachability and waste characterization results. The SPLP results indicate that leaching is unlikely under natural precipitation conditions. No metals were detected in any SPLP samples. One composite sample of aliquots from all three piles also was analyzed for asbestos content. The waste was found to contain 1.25 percent asbestos.

Waste characterization was conducted during the EE/CA process. SPLP was determined to be the most appropriate test to evaluate onsite encapsulation options because it represents leaching in a natural environment and reflects the conditions anticipated for an onsite repository. Additional WET and TCLP analyses were conducted during the EE/CA investigation to determine the waste classification for offsite disposal options. The waste characterization results indicate that the waste would be classified as non-Resource Conservation and Recovery Act (RCRA) California hazardous waste. Table 7 presents the leachability and waste characterization results.

2.3.5. Data Quality and Evaluation of Historical Data

Samples collected as part of this EE/CA were analyzed for metals by TestAmerica Laboratories, Inc. (TestAmerica) and for asbestos by Micro Analytical Laboratories, Inc. (Micro). TestAmerica is accredited by the California Environmental Laboratory Accreditation Program. Micro is accredited by the State of California for analysis of bulk asbestos.

Metals were analyzed by EPA Method 6010B using the following three procedures: SPLP, WET, and TCLP. Asbestos was analyzed by California Air Resources Board Method 435 at a sensitivity of 0.250 percent. The laboratory reported no quality control concerns and no data were flagged for metals or asbestos. Data collected during this EE/CA are considered usable for their intended purpose.

Metals data for waste rock, sediment, and surface water presented in Tables 4, 5, and 6 and used for the SRE (Section 3) were taken from the PA/SI. As part of this EE/CA, background sample results collected from several investigations, including the PA/SI, within the Altaville Mining District were compiled and evaluated to establish representative background concentrations for metals (ERRG, 2008, 2012, and 2013a; Science Applications International Corporation, 2007a and 2007b). Appendix D includes the compiled data and methodology used to establish background metals concentrations for the Altaville Mining District. Data published prior to this EE/CA were presumed to have been of sufficient quality to be usable for screening purposes.

Section 3. Streamlined Risk Evaluation

This section summarizes the SRE of potential risks to human health and the environment from exposure to metals at the AOC. Potential risks were evaluated for exposure to (1) waste rock from the former mining operations and (2) sediment and surface water in the unnamed tributary to Copper Creek. The SRE is used to qualitatively evaluate rather than quantify potential risks to justify a removal action and develop appropriate removal action alternatives to reduce risk. Accordingly, the potential risks to human and ecological receptors from exposure to metals were evaluated by comparing AOC concentrations with appropriate screening criteria (see Sections 3.1 and 3.3).

Potential risks to human health were evaluated based on current and future uses at the AOC. Additionally, because the AOC is near an unnamed tributary that flows into Copper Creek, potential risks to human health were evaluated based on recreational activities associated with river play (such as swimming). Potential risks to human health were evaluated based on recreational (hiking) and Forest Service uses (personnel walking or working at the AOC). Ecological risks were evaluated based on toxicity effects of metals on select sensitive species exposed to waste rock, sediment, and surface water.

The following subsections describe the selection and screening of COPCs, the SCEM, and risk screening.

3.1. SELECTION AND SCREENING OF CHEMICALS OF POTENTIAL CONCERN

The waste rock, sediment, and surface water data collected during the PA/SI were compiled and screened against site-specific background concentrations. Background concentrations for soil were selected from available data collected within the Altaville Mining District. Soil background concentrations represent an average concentration of soil background samples collected within the Altaville Mining District. Appendix D presents the methodology for calculating background soil concentrations. Sediment and surface water background samples were collected from upstream of the AOC and represent background concentrations for the tributary, which passes through the AOC only.

Tables 4, 5, and 6, respectively, summarize the analytical data for metals in waste rock, sediment, and surface water samples collected in 2011 during the PA/SI. Tables 8, 9, and 10, respectively, present the background concentrations for waste rock, sediment, and surface water. If a concentration exceeded the established background concentration in one or more samples for a given matrix, it was retained as a COPC and evaluated further in the SRE (see Section 3.3). If a concentration did not exceed the background concentration in any sample or the metal was not detected at a concentration greater than the laboratory reporting limit in any sample, the metal was not considered a COPC and was not evaluated further in the

SRE. Essential nutrients, including calcium, iron, magnesium, potassium, and sodium, were excluded from the SRE (EPA, 1989; California Environmental Protection Agency, 1992).

The locations of both samples collected during the 2009 preliminary survey were resampled during the PA/SI, and the resulting data are included in the PA/SI report. Therefore, the 2009 waste rock and surface water data are not included in the data set for the SRE. The analytical results for metals in waste rock, sediment, and surface water samples are summarized below.

Waste Rock: Antimony, arsenic, copper, lead, mercury, selenium, silver, and zinc were detected at concentrations exceeding their respective background concentrations, thus they were retained as COPCs in waste rock. Barium, beryllium, cadmium, chromium, cobalt, molybdenum, nickel, thallium, and vanadium were not detected at concentrations greater than the laboratory reporting limit or their respective background concentrations and were not retained for further screening. Table 8 presents the background screening results for the waste rock samples.

Sediment: Antimony, arsenic, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were detected at concentrations exceeding their respective background concentrations, thus they were retained as COPCs in sediment. Barium, beryllium, cadmium, mercury, molybdenum, selenium, silver, and thallium were not detected at concentrations greater than the laboratory reporting limit or their respective background concentrations and were not retained for further screening. Table 9 presents the background screening results for the sediment samples.

Surface Water: No metals were detected at concentrations exceeding background concentrations; therefore, no COPCs were retained for further screening in surface water. Table 10 presents the background screening results for surface water samples.

Based on the background screening evaluation, the following metals were retained as COPCs and were evaluated further in the SRE.

Waste Rock
- Antimony
- Arsenic
- Copper
- Lead
- Mercury
- Selenium
- Silver
- Zinc

Sediment
- Antimony
- Arsenic
- Chromium
- Cobalt
- Copper
- Lead
- Nickel
- Vanadium
- Zinc

Surface Water
- None

3.2. SITE CONCEPTUAL EXPOSURE MODEL

This section describes the methods used to estimate exposures for potential receptors at the AOC. The exposure assessment provides a scientifically defensible basis for the selection of potentially exposed hypothetical receptors and the most likely ways they could be exposed to chemicals at the AOC. To develop a conceptual understanding of the AOC, information on potential chemical source, chemical release and transport mechanisms, locations of potentially exposed human and ecological receptors, and potential exposure routes were assessed. This information is outlined schematically in the SCEM shown on Figure 4. The SCEM associates the source of chemicals with potentially exposed receptors and complete exposure pathways. In this way, the SCEM assists in quantifying potential impacts to human and ecological health.

All of the following four components are necessary for a chemical exposure pathway to be considered complete and for chemical exposure to occur (EPA, 1989):

- A chemical source and a mechanism of chemical release to the environment
- An environmental transport medium (such as soil) for the released chemical
- A point of contact between the contaminated medium and the receptor (the exposure point)
- An exposure route (such as dermal contact with chemically impacted soil) at the exposure point

In evaluating the first two components, chemical properties of the detected chemicals and the physical characteristics of the AOC were reviewed to identify factors that could allow the release and transport of a chemical from the AOC. As shown on Figure 4, the primary source of contamination is the waste rock piles from former mine operations at the AOC. The primary release mechanisms are mechanical and physical disturbance (including crushing native bedrock), resulting in the creation of waste rock piles at the AOC. Transport of chemicals could occur through wind erosion (fugitive dust), invasive soil activities (such as digging), lateral migration of chemicals through storm water runoff/erosion, and leaching and infiltration of chemicals. As a result, potential exposure media at the AOC may include particulates (with sorbed chemicals) in air, surface and subsurface soil, sediment and surface water, and groundwater. Three domestic groundwater wells are within a 4-mile-radius of the AOC (Table 1). No data have been collected to determine if groundwater at or near the AOC has been impacted by metals in waste rock. However, SPLP results (Table 7) indicate that metals do not leach from waste rock under natural precipitation conditions. Based on these results, it is unlikely that metals from the AOC are leaching to groundwater beneath the AOC at concentrations that pose risk to human receptors.

The third component necessary for an exposure pathway to be complete is a point of contact between the contaminated medium and the receptor (the exposure point). The SRE evaluates potential exposure of receptors assuming that access to the AOC is unrestricted and that receptors are exposed directly to impacted waste rock, sediment, and surface water. Currently, access to the AOC is unrestricted and the AOC may be visited by recreational users. An unnamed tributary is in direct contact with mine waste at the AOC, and creeks and rivers downstream from the AOC are potential spawning habitats for fish. Under current and future land-use scenarios, the current and future camper/worker receptor (recreational hiking

and Forest Service worker receptors) may be directly exposed to contaminated waste rock at the AOC. For waste rock, the exposure point is defined as the waste rock piles (Figure 2). For sediment and surface water, the exposure point is sediment and surface water in the unnamed tributary, which flows through the AOC toward Copper Creek.

In addition to exposure points, potential human and ecological receptors at the AOC are necessary for an exposure pathway to be complete. Hypothetical human and ecological receptors evaluated in the SRE were identified based on their proximity to the AOC, proposed activities that could result in exposure to chemicals, and future AOC use. (The AOC is located within the Six Rivers National Forest, and land use is expected to remain recreational in the future.) Based on the current and potential future uses of the AOC, the following hypothetical human and ecological receptors were evaluated in the SRE:

- Hypothetical Current/Future Human Receptors
  - Onsite Camper/Worker Receptor
  - Offsite Water Recreational Visitor
  - Offsite Domestic Groundwater User
- Hypothetical Current/Future Ecological Receptors
  - Terrestrial Wildlife
  - Fish and Aquatic Invertebrates

The fourth and final component, a complete exposure pathway (route of exposure), is discussed in combination with the third component (presence of receptors) to define exposure pathways considered to be complete and significant. As indicated in the SCEM (Figure 4), potential contact with detected chemicals at the AOC could occur through exposure to waste rock, sediment, and surface water. The primary transport mechanism at the AOC is physical erosion of material from waste rock piles to creek sediments. The exposure pathways for each receptor are summarized below.

Hypothetical Onsite Camper/Worker Receptor

The hypothetical onsite camper/worker receptor is included in the SRE to represent both recreational visitors (hikers) and Forest Service workers. This receptor spends the day conducting outdoor activities, which may include moderate soil invasive activities in surface or near-surface soil. This receptor may also interact with sediment and surface water. The following exposure pathways are assumed to be complete and significant for the hypothetical onsite camper/worker receptor:

- Inhalation of dust in outdoor air generated from waste rock
- Incidental ingestion of soil, sediment, and surface water
- Dermal contact with soil, sediment, and surface water

Hypothetical Offsite Water Recreational Visitor Receptor

The hypothetical offsite water recreational visitor receptor is included in the SRE to represent a recreational visitor (swimmer or angler). This receptor spends the day conducting outdoor activities in the unnamed tributary that flows into Copper Creek. The following exposure pathways are assumed to be complete and significant for the hypothetical offsite water recreational visitor receptor:

- Incidental ingestion of sediment and surface water
- Dermal contact with sediment and surface water
- Ingestion of fish

Hypothetical Offsite Domestic Groundwater User Receptor

Because domestic wells are present near (i.e., within 4 miles) of the AOC, the hypothetical offsite domestic groundwater user receptor is included in the SRE. No groundwater data are available to directly evaluate the impacts to groundwater or any subsequent impacts to potential groundwater users, thus groundwater remains a data gap. However, SPLP leachability data (Table 7) indicate that metals do not leach from waste rock under natural precipitation conditions. Therefore, groundwater is unlikely to be impacted.

The following exposure pathways are assumed to be complete but minor for the hypothetical offsite domestic groundwater user receptor:

- Incidental ingestion of groundwater
- Dermal contact with groundwater

Hypothetical Terrestrial Wildlife Receptor

The hypothetical terrestrial wildlife receptor is included in the SRE to represent ecological receptors that forage at the AOC or whose home range includes the AOC. The following exposure pathways are assumed to be complete and significant for the hypothetical terrestrial wildlife receptor:

- Inhalation of dust in outdoor air generated from waste rock
- Incidental ingestion of soil sediment and surface water
- Dermal contact with soil, sediment, and surface water

Hypothetical Fish and Aquatic Invertebrate Receptor

The hypothetical fish and aquatic invertebrate receptor is included in the SRE to represent ecological receptors that reside in the unnamed tributary to Copper Creek. The following exposure pathways are assumed to be complete and significant for the hypothetical fish and aquatic invertebrate receptor:

- Incidental ingestion of sediment and surface water
- Dermal contact with sediment and surface water

3.3. RISK SCREENING

Potential risks to human and ecological receptors from metals were evaluated by comparing the metal concentrations in each medium (waste rock, sediment, and surface water) with appropriate screening criteria developed for protection of human health and the environment. Metals were retained as chemicals of concern (COCs) in all media whose sample results exceeded the screening criteria.

The human health screening criteria are summarized below.

- **Waste Rock Human Health Screening Criteria:** The hypothetical camper/worker receptor (recreational visitor and Forest Service worker) was identified as the primary human receptor that could be exposed to contamination from the AOC. As a result, the BLM RMCs for protection of campers were selected as the screening criteria for metals in waste rock (BLM, 2004). If a BLM RMC was not available for a metal, then the EPA regional screening level (RSL) for industrial soil (EPA, 2013b) was used as the screening criterion.
- **Sediment Human Health Screening Criteria:** The hypothetical water recreational receptor was identified as the primary human receptor that could be exposed to contamination from the AOC in sediment and surface water in the unnamed tributary that flows into Copper Creek. As a result, the BLM RMCs for protection of campers were selected as the screening criteria for metals in sediment (BLM, 2004). If a BLM RMC was not available for a metal, then the EPA RSL for industrial soil (EPA, 2013b) was used as the screening criterion.

  The BLM RMCs for protection of campers are lower, thus more conservative, than the BLM RMCs for protection of swimmers. Therefore, the use of BLM RMCs for protection of campers also is protective of potential swimmer receptors.
- **Surface Water Human Health Screening Criteria:** Similar to sediment, the BLM RMCs for protection of campers were selected as the screening criteria for metals in surface water (BLM, 2004). To account for the ingestion of fish exposure pathway, the EPA National Ambient Water Quality Criteria (NAWQCs) for ingestion of water and fish (EPA, 2013a) also were selected as screening criteria for metals in surface water. The lowest screening criteria were used in the SRE.

  The BLM RMCs for protection of campers are lower, thus more conservative, than the BLM RMCs for protection of swimmers. Therefore, the use of BLM RMCs for protection of campers also is protective of potential swimmer receptors.

The ecological screening criteria are summarized below.

- **Waste Rock Ecological Screening Criteria:** BLM median wildlife and livestock RMCs for soil were selected as the screening criteria for metals in waste rock (BLM, 2004). If a BLM RMC was not available for a metal, then the lowest available EPA ecological soil screening level (Eco-SSL) (EPA, 2014) was used as the screening criterion.
- **Sediment Ecological Screening Criteria:** The threshold effects levels (TELs) developed to evaluate sediment quality in freshwater ecosystems were selected as the screening criteria for metals in sediment (Buchman, 2008).
- **Surface Water Ecological Screening Criteria:** EPA's NAWQCs for protection of freshwater aquatic life (chronic exposure), which were developed to protect fish and lower trophic level species in fresh water, were used as the screening criteria for metals in surface water (EPA, 2013a). EPA criteria are available for both acute and chronic exposure. The criteria based on chronic exposure are lower and therefore more conservative. As a result, the chronic exposure criteria were used in the SRE.

To evaluate risk, the BLM suggests interpreting exceedances of the RMCs as follows (BLM, 2004):

- Less than the criterion: low risk
- 1 to 10 times higher than the criterion: moderate risk
- 10 to 100 times higher than the criterion: high risk
- Greater than 100 times the criterion: extremely high risk

Tables 8, 9, and 10 summarize the results of the screening evaluation for the waste rock, sediment, and surface water samples, respectively. Section 3.3.1 summarizes the SRE results, and Section 3.3.2 presents the SRE conclusions. Section 3.3.3 discusses the data gaps identified and their effect, if any, on the removal action. Screening criteria primarily are established for exposure through the ingestion pathway. Although criteria are not available for inhalation or dermal contact, screening against established ingestion criteria shows whether or not a risk exists at the AOC.

3.3.1. SRE Results

The methods used to screen risk to human and ecological receptors at the AOC and the SRE results are summarized below.

Human Health Receptors

Waste Rock: Of the eight COPCs identified during the background screening, only arsenic and copper concentrations exceeded the human health screening criteria (Table 8). Arsenic concentrations exceeded the BLM RMC of 20 milligrams per kilogram (mg/kg) in the samples from Waste Rock Piles 1, 2, and 3, with concentrations ranging from 42 to 110 mg/kg. Copper concentrations exceeded the BLM RMC of

5,000 mg/kg in the samples from Waste Rock Piles 1, 2, and 3, with concentrations ranging from 5,200 to 32,000 mg/kg.

Based on the magnitude of the exceedances in relation to the screening criteria, arsenic and copper were considered to pose "moderate risk" of adverse effects to human receptors exposed to waste rock in Piles 1, 2, and 3. Waste Rock Pile 4 was not considered to pose risk to human receptors.

Sediment: Of the nine COPCs identified during the background screening, only cobalt and nickel concentrations exceeded the human health screening criteria (Table 9). In one of the two sediment samples, the cobalt concentration exceeded the EPA RSL of 300 mg/kg at a concentration of 350 mg/kg. In one of the two sediment samples, nickel concentrations exceeded the BLM RMC of 3,094 mg/kg at a concentration of 4,000 mg/kg.

Based on the magnitude of the exceedances in relation to the screening criteria, cobalt and nickel were considered to pose "moderate risk" of adverse effects to human receptors exposed to sediment.

Surface Water: Based on the background screening, no COPCs were identified in surface water (Table 10). Therefore, potential human receptors that contact surface water in the unnamed tributary that flows into Copper Creek are not likely to be adversely affected by metals from the AOC.

Ecological Receptors

Waste Rock: Of the eight COPCs identified during the background screening, antimony, copper, selenium, and silver concentrations exceeded the ecological screening criteria (Table 8). Antimony concentrations exceeded the Eco-SSL of 0.27 mg/kg in all four waste rock samples, with concentrations ranging from 4.1 to 8.3 mg/kg. Copper concentrations exceeded the BLM RMC of 136 mg/kg in the samples from Waste Rock Piles 1, 2, and 3, with concentrations ranging from 5,200 to 32,000 mg/kg. Selenium concentrations exceeded the Eco-SSL of 0.52 mg/kg in the samples from Waste Rock Piles 1, 2, and 3, with concentrations ranging from 9 to 52 mg/kg. The reporting limit of 3.8 was greater than the screening criterion in one sample and was treated as an exceedance. Silver concentrations exceeded the Eco-SSL of 4.2 mg/kg in the samples from Waste Rock Piles 1 and 3, with concentrations ranging from 7.5 to 8.4 mg/kg.

Based on the magnitude of the exceedances in relation to the screening criteria, antimony and selenium are considered to pose "high risk," copper is considered to pose "extremely high risk," and silver is considered to pose "moderate risk" of adverse effects to ecological receptors exposed to waste rock.

Although antimony and selenium were detected at concentrations exceeding ecological screening criteria at Waste Rock Pile 4, they were not detected at concentrations exceeding background, thus Waste Rock Pile 4 is not considered to pose a risk of adverse effects to ecological receptors.

Sediment: Of the nine COPCs identified during the background screening, antimony, arsenic, chromium, cobalt, copper, and nickel concentrations exceeded the ecological screening criteria (Table 9). Antimony concentrations exceeded the TEL of 3.0 mg/kg in both samples at concentrations of 8.7 and 14 mg/kg. Arsenic concentrations exceeded the TEL of 5.9 mg/kg in both samples at concentrations of 12 and 21 mg/kg. Chromium concentrations exceeded the TEL of 37.3 mg/kg in both samples at concentrations of 1,400 and 2,400 mg/kg. Cobalt concentrations exceeded the TEL of 50 mg/kg in both samples at concentrations of 130 and 350 mg/kg. Copper concentrations exceeded the TEL of 35.7 mg/kg in both samples at concentrations of 95 and 120 mg/kg. Nickel concentrations exceeded the TEL of 18 mg/kg in both samples at concentrations of 2,300 and 4,000 mg/kg.

Based on the magnitude of the exceedances in relation to the screening criteria, antimony, arsenic, cobalt, and copper are considered to pose "moderate risk," chromium is considered to pose "high risk," and nickel is considered to pose "extremely high risk" of adverse effects to ecological receptors exposed to sediment at the Mammoth AOC. Vanadium was considered a COPC because concentrations in both samples exceeded the background concentration, but no ecological sediment screening criteria are available for vanadium.

Surface Water: Based on the background screening, no COPCs were identified in surface water (Table 10). Therefore, ecological receptors that contact surface water in the unnamed tributary that flows into Copper Creek are not likely to be adversely affected by contaminants from the AOC.

3.3.2. SRE Conclusions

Based on the SRE results, human and ecological receptors that contact contaminated waste rock or sediment at the AOC could be exposed to metals at concentrations that pose an unacceptable risk. Surface water is not expected to pose unacceptable risk to human or ecological receptors.

The following metals were identified as COCs in waste rock and sediment at the AOC.

Human Health Receptors

Waste Rock	Sediment	Surface Water
▪ Arsenic–Moderate Risk	▪ Cobalt–Moderate Risk	▪ None
▪ Copper–Moderate Risk	▪ Nickel–Moderate Risk	

Ecological Receptors

Waste Rock	Sediment	Surface Water
▪ Antimony–*High Risk*	▪ Antimony–Moderate Risk	▪ None
▪ Copper–*Extremely High Risk*	▪ Arsenic–Moderate Risk	
▪ Selenium–*High Risk*	▪ Chromium–*High Risk*	
▪ Silver–Moderate Risk	▪ Cobalt–Moderate Risk	
	▪ Copper–Moderate Risk	
	▪ Nickel–*Extremely High Risk*	
	▪ Vanadium–No screening criteria	

Based on the BLM RMC interpretation presented in Section 3.3.1, the risk to human receptors ranges from "low" to "high," whereas the risk to ecological receptors ranges from "low" to "extremely high." The extremely high ecological risks are from copper in waste rock and nickel in sediment. It is anticipated that, by removing mine wastes from the AOC, risks to human health and the environment risks would addressed. Metals concentrations in material from Waste Rock Piles 1, 2, and 3 exceeded both human health and ecological criteria and are recommended for further action.

3.3.3. Data Gaps

The groundwater pathway was not fully evaluated during this investigation and is considered a data gap (as discussed in Section 3.2). However, it is anticipated that removal of the waste rock piles, based on the SRE results (Section 3.3.2), will address the source of metals contamination at the site (i.e., waste rock piles) and any potential source of groundwater contamination. As a result further evaluation of the groundwater pathway data gap will be unnecessary. In addition, the SPLP results indicate that leaching is unlikely under natural precipitation conditions as discussed in Section 2.3.4

Section 4. Removal Action Goals and Objectives

The purpose of this EE/CA is to develop and analyze removal action alternatives in accordance with CERCLA and to recommend a removal action alternative that is protective of human health and the environment and compliant with ARARs. The removal action alternative will be selected in an Action Memorandum, which is to be prepared by the lead federal agency (the Forest Service). The following sections describe the preliminary RAOs for the AOC and the generalized removal schedule. The RAOs for the AOC may be altered after this EE/CA report is submitted if additional information becomes available from stakeholders or other interested parties that requires reevaluation of the RAOs. As such, the Action Memorandum will define the final RAOs to reflect any alterations and refinements.

4.1. PRELIMINARY REMOVAL ACTION OBJECTIVES

Based on the SRE results, antimony, arsenic, copper, selenium, and silver in waste rock and antimony, arsenic, chromium, cobalt, copper, nickel, and vanadium in sediment at the AOC pose potential risks to both humans and wildlife. Achieving the preliminary RAOs will ensure that potential humans and wildlife are protected from elevated metals concentrations in source materials (i.e., waste rock piles) and in sediment (impacted by erosion of waste rock piles) at and downstream of the AOC. The following preliminary RAOs were developed to reduce the risks to humans and wildlife at the AOC:

- Reduce exposure of humans and wildlife to the waste rock piles, which contain metals at concentrations exceeding human health and ecological screening criteria
- Reduce the risk of erosion of waste rock into surface waterways as sediment

These RAOs will be achieved through removal of waste rock piles and implementation of post-removal erosion control measures. Removing the source of contamination (i.e., the waste rock piles) will reduce the possibility for future erosion and impacts to downstream sensitive environments.

Because the concentrations of metals at mine sites are inherently high, numeric cleanup levels were not established for this project. The removal action will address waste rock piles that were created through the mining process, where native (bedrock) materials were crushed and placed along the creek banks, allowing the materials to erode into downstream sensitive habitats and impact creek sediments. Because the material that makes up the waste rock is visually distinct from native materials, the preliminary RAOs established for the project will be achieved based on visual confirmation that all waste rock has been removed. By achieving the RAOs, the source materials (i.e., waste rock piles) will be removed and potential risks to human health and the environment will be reduced. Figure 5 shows the waste rock piles identified for removal.

4.2. REMOVAL SCHEDULE

The Forest Service has determined that an NTCRA is appropriate for the AOC. The NTCRA could begin within 6 months after approval of this EE/CA report. Based on past experience with implementation of removal action alternatives similar to those proposed in this EE/CA report and the volume of material to be removed, it is estimated that the removal action could be completed within one construction season, depending on the date of contract award.

Section 5. Applicable or Relevant and Appropriate Requirements

Section 300.415(i) of the NCP requires removal actions to attain ARARs to the extent practical, considering the exigencies of the situation. In general terms, ARARs are environmental regulations, standards, criteria, or limitations promulgated under federal or more stringent state laws. An ARAR may be either applicable or relevant and appropriate, but not both.

Applicable requirements are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the law or regulation directly address the circumstances at the AOC. An applicable federal requirement is considered an ARAR. An applicable state requirement is an ARAR only if it is more stringent than a federal ARAR.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are cleanup criteria or limitations promulgated under federal or state law that, while not applicable to the specific situation at a CERCLA site, address problems or situations similar to the circumstances of the proposed removal action and are well suited to the conditions of the site (EPA, 1988). A requirement must be determined to be both relevant and appropriate to be considered an ARAR.

To qualify as a state ARAR under CERCLA and the NCP, a state requirement must be a promulgated law, substantive, consistently applied, and more stringent than a federal requirement. Provisions of generally relevant federal and state statutes and regulations determined to be procedural or non-environmental, including permit requirements, are not considered ARARs. Non-promulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. However, such requirements may be useful and are "to be considered" (TBC) for guiding decisions regarding cleanup goals or methodologies when regulatory standards are not available.

EPA has developed three categories of ARARs to assist in the identification of site requirements: (1) chemical-specific, (2) location-specific, (3) and action-specific. EPA guidance recognizes that some requirements do not fall neatly into this classification. However, the definitions summarized below provide a general guideline for each category.

- Chemical-Specific ARARs are usually health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numeric values (such as cleanup levels). These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment.
- Location-Specific ARARs are restrictions placed on the concentrations of hazardous substances or the conduct of activities solely because they occur in special locations. Location-specific ARARs relate to the geographical or physical position of the site (such as the presence of wetlands, sensitive species, flood plains, etc.).
- Action-Specific ARARs are activity-based requirements or limitations on actions taken with respect to hazardous substances.

As the lead federal agency, the Forest Service has primary responsibility for identifying federal ARARs. EPA (1988) guidance recommends that the lead federal agency consult with the state when identifying state ARARs. In a letter dated March 20, 2014, the Forest Service requested ARARs from the following agencies:

- EPA Region 9
- Water Board
- California Department of Toxic Substances Control
- NOAA's National Marine Fisheries Service
- CDFW
- California State Historic Preservation Office
- California Air Resources Board
- Del Norte Department of Health

The federal and state ARARs discussed in this EE/CA represent a preliminary analysis of ARARs. Other federal and state advisories, criteria, or guidance may, as appropriate, be considered in formulating the removal action. The following sections summarize the potential chemical- location- and action-specific ARARs identified for this project. Tables 11 through 14 summarize the ARARs for this project.

5.1. POTENTIAL CHEMICAL-SPECIFIC ARARs

The Forest Service has identified substantive provisions of potential federal and state chemical-specific ARARs for the AOC for surface water, air, and soil as discussed below. Table 11, summarizes the federal chemical-specific ARARs. No state chemical-specific ARARs apply to this AOC.

5.1.1. Surface Water

There are no potential chemical-specific air ARARs for surface water at the AOC. Protection of waterways during construction is evaluated under the action-specific ARARs (see Section 5.3).

5.1.2. Air

There are no potential chemical-specific air ARARs for inhalation of vapors from the AOC. Inhalation of airborne particulates during construction is evaluated under the action-specific ARARs (see Section 5.3).

5.1.3. Soil

Under RCRA, the **Bevill Amendment, 40 Code of Federal Regulations (CFR) Section (§) 261.4(b)(7)**, is an ARAR that excludes mining ores and minerals from hazardous waste classification. This amendment applies to waste piles at the AOC that are from extraction of minerals. Therefore, these waste piles do not warrant regulation as hazardous waste and are not subject to RCRA Subtitle C regulation. This exemption also is recognized by the State of California (**Health and Safety Code § 25143.1[b][1 and 2**]), so waste from the AOC would not receive a hazardous classification under RCRA or California RCRA.

5.2. POTENTIAL LOCATION-SPECIFIC ARARs

Table 12 summarizes the federal location-specific ARARs. No state location-specific ARARs apply to this AOC.

The **Endangered Species Act, Title 16 USC § 1536(a),(h)(1)(B)**, applies to all habitat upon which threatened or endangered species depend. The act states that federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. This act is an ARAR for the AOC because habitat supporting threatened or endangered species is present at the AOC and directly downstream of the AOC. Before any removal action, a biological evaluation may be required to determine the potential for adverse effects or harm to any listed species or habitat that supports listed species (including areas along and downstream of the unnamed tributary within the AOC).

The **Migratory Bird Treaty Act, 16 USC § 703**, prohibits the pursuit, hunting, capturing, or killing, and the attempt to take, capture, or kill any migratory bird. This act is a potential ARAR because it is relevant and appropriate to the AOC. Although no migratory birds specifically have been identified at the AOC, migratory birds may use the AOC seasonally. If migratory bird species are identified at or near the AOC in the future, compliance with this act would be required.

The **Magnuson-Stevens Fishery Conservation and Management Act, 16 USC §§ 1801–1882**, requires conservation and management of specific fisheries. This act is a potential ARAR because it is relevant and appropriate for AOC surface waters; managed fisheries are present downstream of the AOC. The potential effects of removal actions on downstream managed fisheries must be evaluated in the design and removal action work plan, as appropriate.

Historic and cultural resources may be present at the AOC. The adits associated with the AOC qualify as a historic place under the "Preliminary Determination of Eligibility for the National Register of Historic

Places" (Keter, 2011). Therefore, the **National Historic Preservation Act of 1966** (16 USC § 470–470x-6, 36 CFR § 800, and 40 CFR § 6.301[b]) is applicable. In addition, the **Archaeological and Historic Preservation Act, 16 USC § 469–469(c)(1) and 40 CFR § 6.301(c),** which establishes procedures to protect historical and archaeological data, is applicable. Although no historical or archaeological resources have been formally identified at the AOC to date, an evaluation of the potential for these resources to be present on AOC is required before the removal action is conducted. If archaeological resources are identified, compliance with this act would be required. Likewise, the **Archaeological Resources Protection Act of 1979, Public Law No. 96-95, 16 USC § 470aa–470mm**, which prohibits unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources on public lands, is applicable. Compliance with this act would be required if archaeological resources are documented at the AOC in the future.

The **Smith River National Recreation Act, 16 USC §§ 460bbb**, provides provisions for establishing the Smith River Recreation Area, which is managed for preservation of riparian habitat, including preservation of spawning habitat and limitations on disturbing sediment. This act is an ARAR for the AOC because it applies to tributaries of the Smith River. Similarly the **Wild and Scenic River Act, 16 USC §§ 1271-1287**, designates the Smith River and Rowdy Creek (to which Copper Creek is a tributary) as a wild and scenic river. Rivers protected under this act are subject to land-use controls that maintain the use of the river for recreation and preservation. This act is an ARAR for the AOC. The **USDA Forest Service Land Management Plan Standards and Guides and National Recreation Area Act provisions** are considered non-promulgated guidelines for the Smith River National Recreation Area and are included as Attachment 2. The **Copper Creek 2012 Level II Stream Survey** documents the condition of Copper Creek and its tributaries. This document will be used to help maintain the creek throughout the construction process at the same standard as before construction. It has been included as a TBC for the AOC and is included as Attachment 1.

5.3. POTENTIAL ACTION-SPECIFIC ARARs

Tables 13 and 14, respectively, summarize the federal and state action-specific ARARs.

The **Clean Water Act, 33 USC § 1251 et seq.**, which establishes the basic structure for regulating discharges of pollutants to the waters of the United States and regulating quality standards for surface waters, is applicable and is an ARAR for the AOC. Limitations, standards and other permit conditions (applicable to State National Pollutant Discharge Elimination Systems [NPDES] programs) established in **40 CFR § 122.44(k)(2) and (4)** also apply and are ARARs. California's SWRCB has developed general permit requirements pursuant to these federal regulations. Substantive requirements of the SWRCB's **NPDES General Permit for Storm Water Discharges Associated with Construction Activity, Water Quality Order 99-08-DWQ** for all storm water discharges associated with construction activity are TBC in complying with the requirement to apply best management practices (BMPs) for storm water discharges promulgated at 40 CFR § 122.44(k)(2) and (4). For all activities where construction will disturb more than

1 acre, a stormwater pollution prevention plan specifying BMPs to prevent construction pollutants from contacting storm water must be developed and implemented, along with measures to eliminate non-storm water discharges and requirements for BMP inspections.

In addition, the **Water Board Draft Basin Plan Amendment**, which prohibits the discharge of excess sediment during earth-disturbing activities, is TBC for the AOC for any earthmoving activities. The plan amendment states, "The discharge or threatened discharge of excess sediment from human caused activities to waters of the state is prohibited." Excess sediment is defined as "soil, rock, or sediment discharged to waters of the state in an amount that could be deleterious to beneficial uses or cause a nuisance." The removal action design and work plan will consider this proposed amendment and ensure that removal activities are planned in such a way that discharges of excess sediment do not occur.

The **Native American Graves Protection and Repatriation Act, 25 USC § 3001 et seq. 43 CFR Part 10**, requires that Native American graves not be disturbed and that, if discovered, excavation and ground disturbance would be stopped. This requirement is a potential ARAR because it is relevant and appropriate for all ground-disturbing activities at the AOC. Although no Native American graves have been identified at the AOC, if graves or cultural items are discovered, excavation work must stop and affiliated tribes must be notified and consulted before work continues.

The **American Indian Religious Freedom Act, 42 USC § 1996 et seq.**, protects and preserves Native American traditional religious rights and cultural practices, including access to sacred sites, freedom to worship through ceremonial and traditional rights, and use and possession of objects considered sacred. This requirement is a potential ARAR because it is relevant and appropriate for activities at the AOC and requires that site activities have no negative impact on the free practice of religion by Native American groups. If sacred sites are identified within construction areas before or during AOC work, work would be stopped and appropriate Native American groups would be notified before the project continues.

The **California Mining Waste Regulations Pursuant to the California Water Code, § 13172, 27 California Code of Regulations (CCR) §§ 22470–22510**, address the management of mining waste, including specific requirements on siting, construction, monitoring, and closure and post-closure maintenance of existing and new units. These regulations are a potential ARAR for the AOC because it is relevant and appropriate to the construction of onsite encapsulation unit(s).

The **California Air Resources Board, Asbestos Airborne Toxic Control Measure for Construction, 17 CCR § 93105**, sets forth requirements for health protection during earthmoving activities that disturb ultramafic or serpentinite soil. These requirements are a potential ARAR for the AOC because they are applicable to construction activities that would disturb serpentinite soil known to contain asbestos. Monitoring, personal protective equipment, and dust-suppression measures (such as wetting soil) would be required during any activity that disturbs serpentinite soil at the AOC. In addition, the **North Coast Unified Air Quality Management District's Rule 104** prohibits the discharge of hazardous materials to air through

fugitive dust. This non-promulgated rule is TBC for any earthmoving activity to ensure that appropriate monitoring, personal protective equipment, and dust-suppression measures are in place to protect worker health and safety during construction.

Section 6. Identification and Analysis of Removal Action Alternatives

To identify removal action alternatives for the AOC, potential response actions were selected based on the RAOs, ARARs, and EPA guidance (EPA, 1993). The technologies and process options specific to the response actions were screened, and the retained technologies and process options of each general response action were assembled into removal action alternatives. The selected removal action alternatives then were evaluated with respect to their effectiveness, implementability, and cost.

Based on the guidelines presented in the "Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA" (EPA, 1993), only the most qualified technologies that apply to the media or source of contamination should be discussed in the EE/CA. Limiting the number of alternatives to those that have been selected in the past at similar sites or for similar contaminants provides an immediate focus for the discussion and selection of alternatives.

The remainder of this section summarizes the general response actions, evaluation criteria, and analysis of the removal action alternatives with respect to the evaluation criteria.

6.1. GENERAL RESPONSE ACTIONS

Three general response actions were considered for this EE/CA:

- No Action
- Engineering Controls
- Offsite Disposal of Source Materials

The no-action category is retained throughout the evaluation process as required by the NCP to provide a baseline for comparison with other alternatives. Table 15 summarizes the screening of technologies and processes associated with the general response actions. The removal action alternatives discussed in Section 6.3 were identified based on the general response actions.

6.2. EVALUATION CRITERIA

The analysis of removal action alternatives is qualitative in nature and is based on the following three evaluation criteria as recommended by EPA (1993): effectiveness, implementability, and relative cost. The following subsections describe each criterion.

6.2.1. Effectiveness

Alternatives are evaluated for effectiveness based on the criteria listed below.

- Overall Protection of Human Health and the Environment: Assesses the ability of the alternative to be protective of human health and the environment under present and future land use conditions.
- Compliance with ARARs: Determines if implementation of the alternative would comply with all chemical-, action-, and location-specific ARARs.
- Long-Term Effectiveness: Addresses the magnitude of residual risk remaining at the conclusion of removal activities, and addresses the adequacy and reliability of controls established by a removal action alternative to maintain reliable protection of human health and the environment over time.
- Short-Term Effectiveness: Addresses the effects of an alternative during the construction and implementation phase until RAOs are achieved; includes consideration of the time for the remedy to achieve protectiveness and the potential to create adverse impacts on human health and the environment during construction and implementation of the remedy.
- Reduction of Toxicity, Mobility, or Volume through Treatment: Determines if implementation of the alternative would reduce contaminant toxicity (such as reduction of metals toxicity), contaminant mobility, or actual volume of hazardous substances.

6.2.2. Implementability

Alternatives are evaluated for implementability based on the criteria below.

- Technical Feasibility: Evaluates constructability and operational considerations as well as demonstrated performance and useful life.
- Administrative Feasibility: Evaluates activities such as statutory limits, permitting requirements, easements and rights-of-way, and impacts on adjoining property.
- Availability of Services and Materials: Evaluates the availability of qualified contractors to provide the necessary services, materials, and equipment (with the preferred technologies being those that are commercially developed and readily available or innovative technologies that have been field-tested with documented results); also evaluates the availability of disposal facilities licensed to accept solid and liquid wastes classified as hazardous and nonhazardous.
- State Acceptance: Considers the concurrence of the State of California with the proposed alternative.
- Community Acceptance: Considers the community's acceptance of the proposed alternatives.

6.2.3. Cost

Technologies were evaluated based on qualitative costs. Alternatives with lower costs were preferred if the effectiveness and implementability criteria were judged to be similar. The cost estimates were prepared to aid in the evaluation of alternatives using currently available information. These costs are order-of-magnitude estimates, with an intended accuracy of +50 to -30 percent (EPA, 2000). These costs are not construction bid costs, nor are they final project costs, but are based on best professional judgment (including experience on recent similar projects and actual vendor quotes, as appropriate). Final project costs will depend on actual labor and material costs, actual engineering design costs, actual site conditions (including the actual quantities of soil excavated and the amount of material that may be classified as hazardous waste), competitive market conditions (including prices of commodities such as fuel), the final project scope, the final project schedule, and other variables. As a result, the final project costs may vary from the estimates.

6.3. ANALYSIS OF REMOVAL ACTION ALTERNATIVES

The following removal action alternatives were identified for the AOC based on the general response actions and screening discussed in Section 6.1:

1. Alternative 1: No Action
2. Alternative 2: Removal and Onsite Encapsulation (at the AOC)
3. Alternative 3: Removal and Onsite Encapsulation (within the Altaville Mining District near the AOC)
4. Alternative 4: Removal and Offsite Disposal

Each alternative was analyzed for its capability to reduce the risks discussed in Section 3. Specifically, the alternatives are analyzed for effectiveness, implementability, and cost as discussed below. Figure 5 shows the removal action features, and Appendix E presents the detailed removal action cost estimate. After the individual analysis of alternatives presented below, each alternative was compared against the others to select the recommended removal action (Section 7).

6.3.1. Alternative 1: No Action

Under Alternative 1, no action would be taken at the AOC under current or future land-use scenarios. As such, the human and ecological risks relating to the AOC would remain unchanged. The no-action alternative is evaluated as required by the NCP to provide a baseline for comparison with other alternatives.

Effectiveness

Alternative 1 would not provide short- or long-term protection of public health. This alternative would not comply with ARARs. The time required to achieve the RAO would be indefinite, and risks to current and future receptors would remain indefinitely. The toxicity, mobility, and volume of contamination at the AOC would not be reduced through treatment, and potential receptor exposure pathways would remain for current and future receptors.

Implementability

Alternative 1 would be readily technically and administratively feasible, and no services or materials would be needed for implementation.

Cost

The total estimated cost for Alternative 1 is $0. No costs would be associated with this alternative.

6.3.2. Alternative 2: Removal and Onsite Encapsulation (at the AOC)

Alternative 2 would require the removal of waste rock (approximately 365 cy from three waste rock piles) and the transportation of removed source materials to a designated, onsite upland repository. A tracked long-reach excavator would remove the waste rock piles, including the mine waste that has eroded down the slope from Waste Rock Pile 1 into the unnamed tributary to Copper Creek. A tracked dump truck would transport the waste from the waste rock piles to the repository area at the end of the unpaved road. A front loader and a bulldozer would stockpile waste rock and build the soil cap. Remaining wooden structures, and mining debris related to former mining activities, would be dismantled and disposed of in the repository.

Waste rock would be (1) capped with approximately 1 foot of clean soil from an onsite source, (2) covered with a brightly colored demarcation layer, (3) capped with a second foot of clean soil, and (4) graded for positive surface water drainage. This soil cap would encapsulate the waste and reduce future exposure of human and ecological receptors. The soil cover would require ongoing monitoring and maintenance to ensure that the integrity of the cap is maintained. The brightly colored demarcation layer would alert future workers performing inspections or maintenance so that they do not expose waste material or compromise the integrity of the soil cap. Leachability data indicate that the waste material is unlikely to leach under natural precipitation conditions, so an impermeable liner is not required for encapsulation.

This alternative would require a final engineering study and design to establish siting requirements for the repository, locate an onsite borrow source, and ensure that appropriate requirements are met in terms of waste placement and grading. In order to access the waste rock piles, minor maintenance to the unpaved mine access road would be required from County Route 305 to the Mammoth AOC. A route to the waste piles would be cleared of brush to allow tracked equipment (such as the tracked dump truck and excavator)

to access the waste rock piles. Tracked equipment would be used to minimize Site disturbance and subsequent restoration required in this area. Accessing the piles may require some damage to vegetation, so a habitat and vegetation management plan should be completed in conjunction with the removal action before construction begins to ensure that sensitive plant species are not damaged during construction.

Appropriate engineering and institutional controls would be required during construction to protect workers. These controls would address the presence of metals in waste rock and the high likelihood for metals to become airborne during construction work. The controls may include wetting of roads and waste throughout construction, use of personal protective equipment (such as disposable coveralls and air-purifying respirators), and air monitoring (both personal and site air monitoring).

Future institutional controls may be required to accompany the engineering control design, such as placing signs around the encapsulation area to reduce the potential for erosion of the cap by AOC visitors.

After excavation, the waste rock removal areas would not be backfilled but would instead be graded to natural, pre-mining conditions and covered with erosion control materials. The capped repository also would be covered with erosion control materials, including weed-free rice straw to discourage runoff, promote stabilization, and supply a substrate for vegetative regrowth. Long-term operation and maintenance (O&M) of the cap would be performed annually for 30 years following the removal action. Long-term O&M would consist of visual inspections to evaluate revegetated areas and erosion control measures to ensure the integrity of the repository cap. In addition, the results of the Forest Service's ongoing stream survey program will be used to document stream habitat and fish species at the AOC and to monitor the effectiveness of the removal action. This program includes periodic surveys on Copper Creek that document stream habitat and observed fish species in the creek.

Effectiveness

Alternative 2 would reduce the potential for exposure to metals present at the AOC by removing waste rock from the AOC and encapsulating it. Waste encapsulation is considered effective at eliminating human and ecological exposure to metals at the AOC. It is anticipated that, by removing waste rock from the bank of the unnamed tributary, there would be no future influx of material from the waste piles into the creek, eliminating (1) the potential for contact of human and ecological receptors and (2) future or continued downstream releases. Long-term periodic inspection and maintenance of the soil cover would be required to ensure the long-term integrity of the repository and prevent its compromise through natural erosion or human activities.

It is assumed that the removal activities associated with this alternative would not have severe or lasting effects on sensitive species at and downstream of the AOC. Alternative 2 would achieve the RAOs.

This alternative would comply with all chemical-, location-, and action-specific ARARs and would comply with the stated objectives in the standards and guides for the Smith River National Recreation Area. These standards and guides include maintaining and restoring the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations, and maintaining and restoring the sediment regime under which the aquatic ecosystems evolved. Attachment 2 presents the riparian management standards and statutes for CERCLA abatement of mine tailings at Copper Creek. Although the toxicity, mobility, and volume of contamination at the AOC would not be eliminated through removal and encapsulation, Alternative 2 is considered reliable based on accepted industry standards for similar projects.

Long-term risks to current and future receptors related to waste materials would be reduced. Additionally, this alternative would permanently remove waste from the unnamed tributary to Copper Creek, thereby eliminating the potential for future releases to the creek. An exclusion zone, contaminant reduction zone, and staging area would be established during removal activities to reduce potential migration of contamination to adjacent areas. BMPs and dust monitoring and control also would be implemented under Alternative 2. This alternative would be effective in both the short and the long term.

Implementability

This alternative would be readily implementable using existing construction technologies. The AOC access road likely would require some improvement to allow heavy equipment to be transported to the AOC. A route from the mine access road to Waste Rock Piles 1, 2, and 3 would need to be established using tracked equipment such as an excavator or dump truck. Encapsulation of contaminated materials is a proven technology that has been used extensively for mine waste removal. Implementation of this alternative is not expected to have any negative long-term effects on the ecological health of the creek.

Because mine waste is exempt from RCRA waste disposal criteria while the waste is located within a mining area (40 CFR § 261.4[b][7]), onsite encapsulation of mine waste would not be regulated under hazardous waste disposal and landfill regulations. However, other federal or state requirements regarding appropriate siting, construction, and long-term inspection and maintenance may apply as well as mining waste regulations pursuant to California Water Code § 13172 (at 27 CCR § 22470-22510).

Because the waste piles would be consolidated and encapsulated on site, the Forest Service would ensure that substantive requirements for siting and construction of mine waste impoundments are met to ensure protection of groundwater and surface water downgradient from the consolidation unit (27 CCR §22510). Leachability data indicate that the waste material is unlikely to leach under natural precipitation conditions, so the encapsulated waste would not pose an ongoing threat to groundwater quality.

A potentially appropriate onsite repository area has been identified near the former ore loading area. A removal action work plan would be required before work begins. The work plan should include design drawings and specifications, a sampling and analysis plan, and a site-specific health and safety plan.

Planning documents also should include a vegetation and habitat management plan to ensure that sensitive species in the area are not disturbed.

This alternative likely would be acceptable to the state and community because it would achieve RAOs, improve or restore the habitat for spawning fish, and improve the AOC for recreational use.

Cost

The estimated total capital cost for implementing this alternative is $673,000. The long-term total cost for implementing this alternative is $699,400, with a present value cost of $696,500. The major assumptions summarized below were made to estimate costs for Alternative 2.

- Six personnel and four pieces of equipment would be implementing the removal action.
- The estimated duration of field activities is 32 days.
- The estimated quantity of mine waste requiring excavation is 365 cy.
- A 4,400-square-foot demarcation layer would be placed 1 foot below the top of the soil cap.
- An estimated 424 cy of clean soil would be required to construct the soil cap. It is assumed that this material would be available from an onsite source. The potential onsite backfill source would require testing before use to ensure that the material is suitable for use as clean fill. If an appropriate onsite backfill source is not located, the cost of implementation would increase to account for importing backfill from off site.
- The cost estimate includes botanical oversight to ensure that sensitive plant species are not harmed during construction.
- Waste removal would be confirmed by visual assessment only; costs for confirmation sampling and analysis are not included.
- Approximately 6,200 square feet of area disturbed by the waste removal would be restored to a natural grade and would have BMPs installed.
- Road improvement costs ($100,800) are included in the total costs.
- An estimated $400 per year is assumed for a Gasquet Forest Service employee to perform annual inspections to evaluate the integrity of all cover elements and erosion control measures.
- An estimated $2,500 is assumed every 5 years for a Five-Year Review report.
- An estimated $4,200 is assumed for one repository repair event over the next 30 years.
- The category of “Field Planning and Design Documents” includes costs for office support; project management; health, safety, and regulatory compliance review; meetings and client support; and preparation of the work plan.

6.3.3. Alternative 3: Removal and Onsite Encapsulation (within the Altaville Mining District near the AOC)

Alternative 3 is similar to Alternative 2 (see Section 6.3.2) except that the repository would be located nearby approximately 1 mile from the AOC. Similar to Alternative 2, the mine access road likely would require some improvement to allow heavy equipment to be transported to the AOC. A tracked long-reach excavator would remove the waste rock piles and placed them into a tracked dump truck. The tracked dump truck would stockpile the waste at a staging area. The staging area is located within the AOC near the former ore loading area adjacent to Waste Rock Pile 3 (see Figure 2). A second excavator would load the articulated dump truck, which would transport the waste rock to the repository area. An excavator and a bulldozer would stockpile waste rock and build the soil cap. Remaining wooden structures, and mining debris related to former mining activities, would be dismantled and disposed of in the repository.

The repository design and construction, study and design requirements, appropriate engineering and institutional controls, restoration activities, and long-term O&M would be the same as described in Section 6.3.2. In addition, the results of the Forest Service's ongoing stream survey program would be used to document the stream habitat and fish species at the AOC and to monitor the effectiveness of the removal action. This program includes periodic surveys on Copper Creek that document stream habitat and observed fish species in the creek.

Effectiveness

Because the scope of Alternative 3 is the same as Alternate 2, the effectiveness of both alternatives would be the same. The nearby repository location would be in a setting comparable to the onsite location of the repository under Alternate 2 and therefore would have similar effectiveness. Alternative 3 would be effective in both the short and the long term.

Implementability

Because the scope of Alternative 3 is the same as Alternate 2, the implementability of both alternatives would be the same. An appropriate repository area has been identified approximately 1 mile south of the AOC. Similar to Alternate 2, this alternative likely would be acceptable to the state and community because it would achieve RAOs, improve or restore the habitat for spawning fish, and improve the area for recreational use.

Cost

The estimated total capital cost for implementing this alternative is $761,500. The long-term total cost for implementing this alternative is $787,900, with a present value cost of $785,000. The major assumptions summarized below were made to estimate costs for Alternative 3.

- Seven personnel and six pieces of equipment would be implementing the removal action.
- The estimated duration of field activities is 30 days.
- The estimated quantity of mine waste requiring excavation is 365 cy.
- A 4,400-square-foot demarcation layer would be placed 1 foot below the top of the soil cap.
- An estimated 424 cy of clean soil would be required to construct the soil cap. It is assumed that this material would be available from an onsite source. The potential onsite backfill source would require testing before use to ensure that the material is suitable for use as clean fill. If an appropriate onsite backfill source is not located, the cost of implementation would increase to account for importing backfill from off site.
- The cost estimate includes botanical oversight to ensure that sensitive plant species are not harmed during construction.
- Waste removal would be confirmed by visual assessment only; costs for confirmation sampling and analysis are not included.
- Approximately 6,200 square feet of area disturbed by the waste removal would be restored to a natural grade and would have BMPs installed.
- Road improvement ($121,600) costs are included in the total costs.
- An estimated $400 per year is assumed for a Gasquet Forest Service employee to perform annual inspections to evaluate the integrity of all cover elements and erosion control measures.
- An estimated $2,500 is estimated every 5 years for a Five-Year Review report.
- An estimated $4,200 is assumed for one repository repair event over the next 30 years.
- The category of "Field Planning and Design Documents" includes costs for office support; project management; health, safety, and regulatory compliance review; meetings and client support; and preparation of the work plan.

6.3.4. Alternative 4: Removal and Offsite Disposal

Under Alternative 4, waste rock would be removed from the Altaville Mining District using the same methods as under Alternative 2 (see Section 6.3.2). Similar to Alternative 2, the mine access road likely would require some improvement to allow heavy equipment to be transported to the AOC. Waste would be transported to a staging area on County Route 305, where it would be stockpiled and loaded into long-haul trucks for transportation to an appropriate offsite disposal facility. The waste would be hauled to an appropriately licensed disposal facility such as the Dry Creek Landfill in Eagle Point, Oregon. Similar to Alternative 2, a long-reach excavator would remove source materials from the waste rock piles and place the material into a tracked dump truck for transportation to the staging area. A second excavator would load mine waste from the staging area into long-haul dump trucks for offsite disposal. Remaining wooden structures, and mining debris related to former mining activities, would be dismantled and disposed of off site with mine waste.

Similar to Alternative 2, the waste rock pile areas would be restored to pre-mining conditions and covered with erosion controls. Short-term O&M activities would be performed for 5 years after the removal action to ensure that the integrity of the erosion control materials in the former waste rock areas is maintained. No long-term O&M activities would be required under this alternative because all waste rock materials would be completely removed. The results of the Forest Service's ongoing stream survey program would be used to document the stream habitat and fish species at the AOC and to monitor the effectiveness of the removal action. This program includes periodic surveys on Copper Creek that document stream habitat and observed fish species in the creek.

Effectiveness

Alternative 4 would eliminate the potential for exposure to metals present at the AOC and would prevent continued erosion of waste materials from the AOC, thereby eliminating the potential for future or continued downstream releases. Waste removal is considered effective at addressing risks posed to human health and the environment by metals in waste rock. Removal of waste rock from the AOC would eliminate exposure of humans and wildlife.

Because the waste piles would be transported off site, there would be no future threat to onsite water quality, and 27 CCR §22510 does not apply to this alternative. Furthermore, no long-term monitoring would be required.

It is assumed that removal activities associated with this alternative would not have severe or lasting negative effects on the sensitive species at and downstream of the AOC.

This alternative would comply with all chemical-, location-, and action-specific ARARs. The toxicity, mobility, or volume of contamination at the AOC would be eliminated through removal. This alternative is considered reliable based on accepted industry standards for similar projects.

Long-term risks to current and future receptors related to waste materials would be eliminated. Additionally, this alternative would permanently remove waste from the unnamed tributary to Copper Creek, thereby eliminating the potential for future releases to the creek. Similar to Alternative 2, an exclusion zone, contaminant reduction zone, and staging area would be established to reduce potential migration of contamination to adjacent areas. BMPs and dust monitoring and control measures similar to those under Alternative 2 also would be implemented under Alternative 4.

Implementability

This alternative would be readily implementable using existing construction technologies. As discussed under Alternative 2 (see Section 6.3.2), the mine access road likely would require some improvement to allow heavy equipment to be transported to the AOC. A route from the mine access road to Waste Rock Piles 1, 2, and 3 would be established using tracked equipment such as an excavator or dump truck to reduce

potential migration of contamination to adjacent areas. No long-term effect is expected on the ecological health of the creek. Because the waste rock would be transported offsite for disposal, long-term inspection and maintenance are not required.

The closest landfill that would accept waste materials is located in Eagle Point, Oregon, approximately 100 miles away from the site. This alternative is considered technically feasible, and services and materials would be readily available in the vicinity of the site.

This alternative would meet the ARARs specified in Tables 11 through 14. This alternative could be implemented in a way that would minimize environmental impacts and could be performed within one construction season. Excavation and offsite disposal is a proven method for removing exposure pathways to receptors and risk posed to human health. A removal action work plan would be required before work begins. The work plan should include design drawings and specifications, a sampling and analysis plan, and a site-specific health and safety plan. Planning documents also should include a vegetation and habitat management plan to ensure that sensitive species in the area are not disturbed.

This alternative likely would be acceptable to the state and community because it would achieve RAOs, improve or restore the habitat for spawning fish, improve the AOC for recreational use, and not require long-term maintenance.

Cost

The estimated total capital cost for implementing this alternative is $875,200. The long-term total cost for implementing this alternative is $877,200, with a present value cost of $877,100. The major assumptions summarized below were made to estimate costs for Alternative 4.

- Seven personnel and six pieces of equipment would be implementing the removal action.
- The estimated duration of field activities is 33 days.
- Approximately 365 cy of material would be would be hauled, stockpiled, and loaded for offsite transport and disposal. Waste would be exported at a rate of 70 cy per day.
- The cost estimate includes botanical oversight to ensure that sensitive plant species are not harmed during construction.
- Waste removal would be confirmed by visual assessment only; costs for confirmation sampling and analysis are not included.
- Approximately 6,200 square feet of area disturbed by the waste removal would be restored to a natural grade and would have BMPs installed.
- Road improvement ($123,600) costs are included in the total costs.
- The category of “Field Planning and Design Documents” includes costs for office support; project management; health, safety, and regulatory compliance review; meetings and client support; and preparation of the work plan.

- Mine waste is assumed to be non-RCRA California hazardous waste for offsite disposal. It is assumed that the mine waste would be trucked to the Dry Creek Landfill in Eagle Point, Oregon, for disposal purposes. The mobilization cost for the waste hauling trucks is $775 each way. The transportation and disposal costs are $160 per cy. Costs may change significantly if waste is transported to a different disposal facility.

Section 7. Comparative Analysis of and Recommended Removal Action Alternatives

The removal action alternatives identified in Section 6.3 were compared to each other using the evaluation criteria described in Section 6.2. Section 7.1 describes the results of the comparative analysis. Section 7.2 discusses the recommended removal action based on the results of the comparative analysis.

7.1. COMPARATIVE ANALYSIS OF ALTERNATIVES

Table 16 summarizes the comparative analysis of the alternatives, which were evaluated for effectiveness, implementability, and cost as discussed below.

7.1.1. Effectiveness

Alternative 1 is considered the least effective alternative to protect public health and the environment because risks to current and future receptors would remain indefinitely and the toxicity, mobility, and volume of contamination would not be reduced through either treatment or removal. Alternatives 2 and 3 would not reduce the toxicity, mobility, and volume of contamination through treatment but would protect human health and ecological receptors through onsite encapsulation. Alternative 4 would not reduce the toxicity, mobility, or volume of contamination through treatment, but would completely remove waste from the site. Alternative 4 would be the most effective alternative because waste would be completely removed from the site, thereby reducing the risk to current and future receptors.

7.1.2. Implementability

Alternatives 1, 2, 3, and 4 all are technically and administratively feasible, and the services and materials necessary to implement the alternatives are readily available. Alternative 3 is less technically feasible than Alternative 2 because it would require handling the waste two times instead of once before deposit in the repository. Alternative 4 is the least technically feasible because it would require handling the waste three times before transportation to the offsite landfill approximately 100 miles from the site. Alternative 1 is the most implementable because no administration, services, or materials would be required. Alternatives 2, 3, and 4 are very implementable and could be conducted within one construction season.

7.1.3. Cost

The estimated cost for Alternative 1 is $0. The estimated capital cost for Alternative 2 is $673,000, and the total cost with ongoing maintenance is $699,400. The estimated capital cost for Alternative 3 is $761,500, and the total cost with ongoing maintenance is $787,900. The estimated capital cost for Alternative 4 is $875,200, and the total cost with ongoing maintenance is $877,200. Alternative 2 is the most cost-effective alternative in the long term.

7.2. RECOMMENDED REMOVAL ACTION ALTERNATIVE

The removal action alternative recommended for the Mammoth AOC is **Alternative 2, Removal and Onsite Encapsulation (at the AOC)**. Alternatives 2, 3, and 4 would achieve the RAOs and are very similar in cost. Alternative 2 is more cost-effective than Alternatives 3 or 4 in the long term.

The estimated total capital cost for implementing Alternative 2 is $673,000. As discussed in Section 6.2.3, this cost represents an order-of-magnitude estimate with an intended accuracy of +50 to -30 percent (EPA, 2000). Final project costs will depend on actual labor and material costs, actual engineering design costs, actual site conditions (including the actual quantities of source materials excavated), competitive market conditions, the final project scope, the final project schedule, and other variables.

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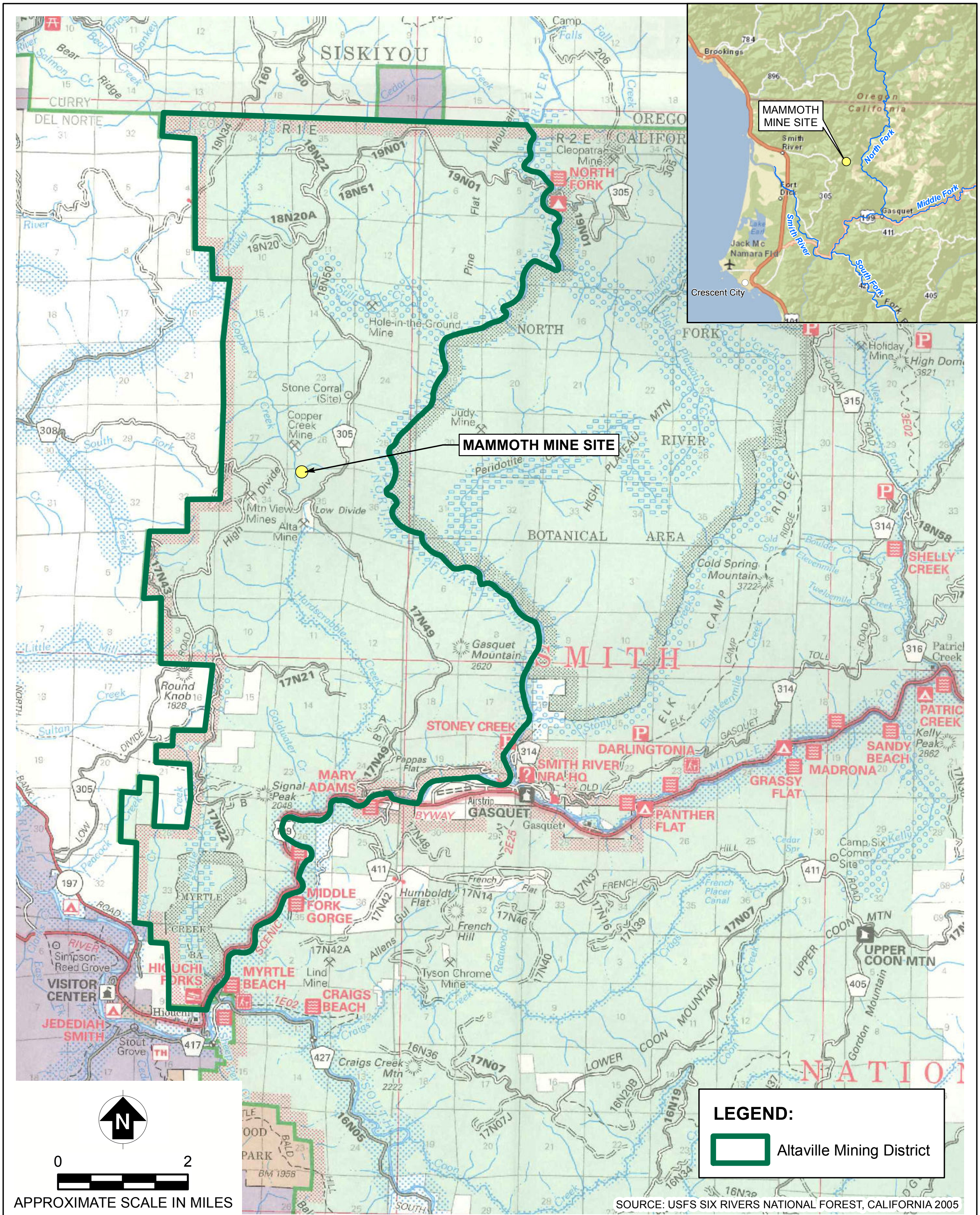
Figures



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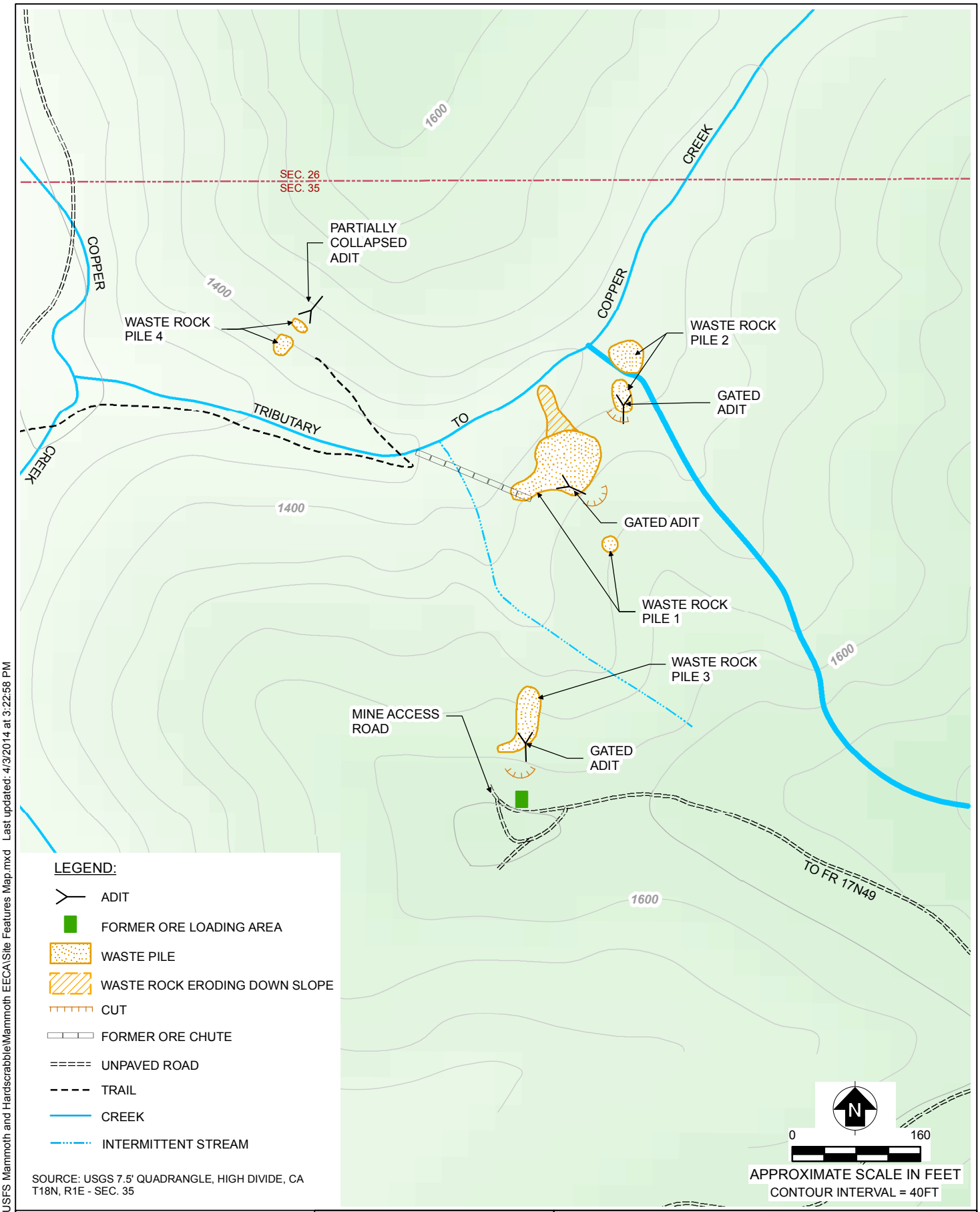
	LOCATION: MAMMOTH MINE SIX RIVERS NATIONAL FOREST, CA	DRAWN BY: JJC 2/13/14	CHECKED BY: SCK 2/13/14	ERRG PROJECT NO. 2013-057	FIG NO. 1



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T18N, R1E - SEC. 35

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ERRG
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(415) 395-9974

CLIENT:	AOC FEATURES MAP			
U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE				
LOCATION:	DRAWN BY:	CHECKED BY:	ERRG PROJECT NO.	FIG NO.
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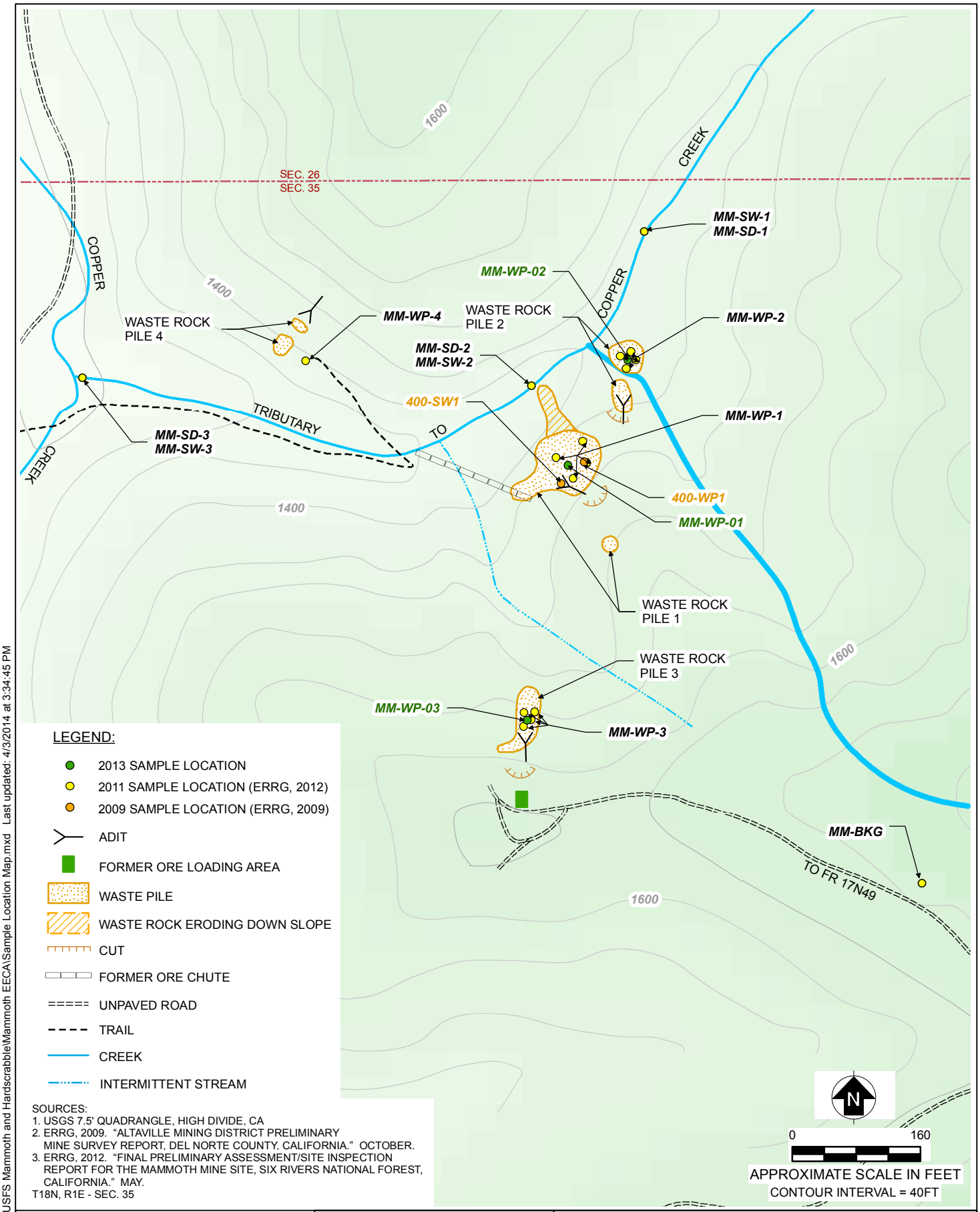

SOURCES:
1. USGS 7.5' QUADRANGLE, HIGH DIVIDE, CA
2. ERRG, 2009. "ALTAVILLE MINING DISTRICT PRELIMINARY MINE SURVEY REPORT, DEL NORTE COUNTY, CALIFORNIA." OCTOBER.
3. ERRG, 2012. "FINAL PRELIMINARY ASSESSMENT/SITE INSPECTION REPORT FOR THE MAMMOTH MINE SITE, SIX RIVERS NATIONAL FOREST, CALIFORNIA." MAY.

T18N, R1E - SEC. 35

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ERRG
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CLIENT:	SAMPLE LOCATION MAP			
U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE				
LOCATION:	DRAWN BY:	CHECKED BY:	ERRG PROJECT NO.	FIG NO.
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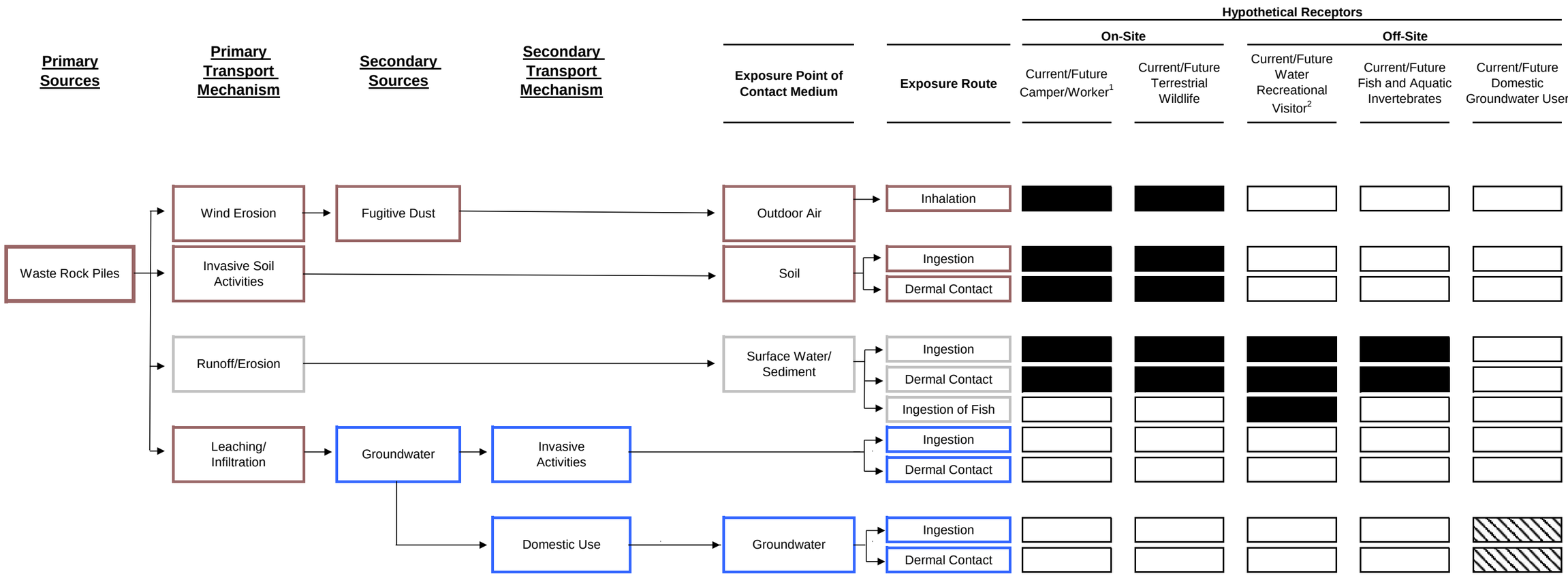

SCEM components related to soil

SCEM components related to groundwater

SCEM components related to surface water and sediment

Receptor likely to be exposed through this route, so pathway considered potentially complete.

Receptor may be exposed through this route; so pathway considered potentially complete; however, pathway is considered minor

Pathway is incomplete; no further evaluation required

Notes:

[1] Hypothetical camper/worker receptor represents both recreational (i.e., hiker) and Forest Service worker receptors.

[2] Hypothetical water recreational receptor represents both recreational and angler receptors

SCEM = site conceptual exposure model

ERRG

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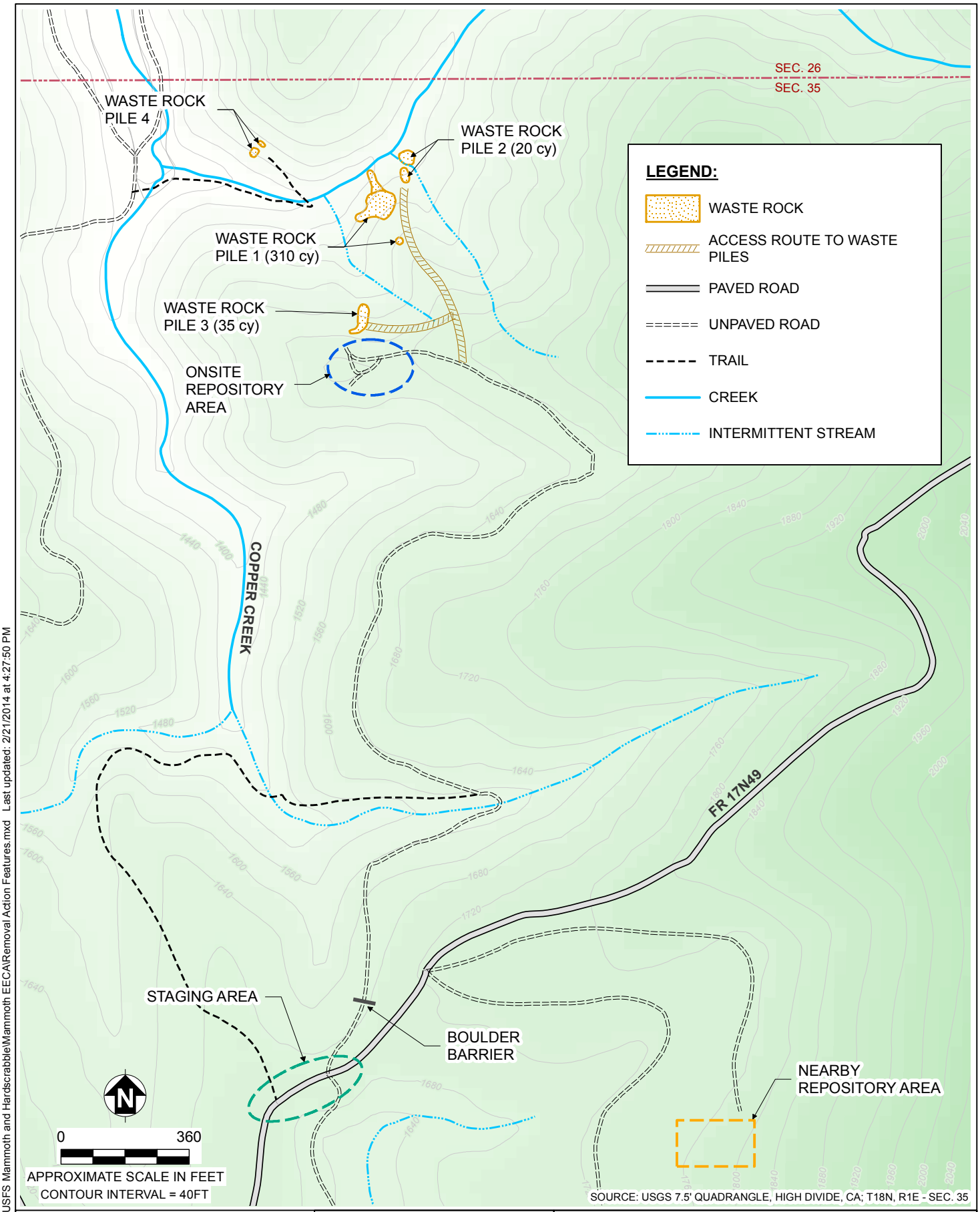
CLIENT:	SITE CONCEPTUAL EXPOSURE MODEL			
U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE				
LOCATION:	DRAWN BY:	CHECKED BY:	ERRG PROJECT NO.	FIG NO.
MAMMOTH MINE, SIX RIVERS NATIONAL FOREST, CA	TC 1/14/2014	SCK	2013-057	4



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	LOCATION: MAMMOTH MINE SIX RIVERS NATIONAL FOREST, CA	DRAWN BY: JJC 2/13/14	CHECKED BY: SCK 2/13/14	ERRG PROJECT NO. 2013-057	FIG NO. 5

Tables

Table 1. Vicinity Groundwater Wells

Township	Range	Section	Owner	Use	Depth to Water (feet bgs)	X Coordinates[1]	Y Coordinates[1]
17N	01E	16	Fortier	DOM	NA	411257.8	4635440
18N	01E	28	Cook Enterprises	DOM	29	411579.2	4641938
18N	01E	30	Simpco Land	DOM	12	408217.8	4641817

Notes:

1 = Coordinates for these wells are within a 4-mile radius of the AOC.

bgs = below ground surface

DOM = domestic well

NA = not available

Source: Search of Department of Water Resources' database conducted in April 2012.

Table 2. Sensitive Animal Species Potentially Present in the Vicinity of the AOC

Common Name	Scientific Name	Federal Status	California Status	Regulatory Agency Status
Amphibians and Reptiles				
Del Norte Salamander	*Plethodon elongatus*	None	None	CDFW California Species of Special Concern
Foothill Yellow-legged Frog	*Rana boylii*	None	None	CDFW California Species of Special Concern (Class 2 - Special Concern)
Northern Red-legged Frog	*Rana aurora*	Threatened	None	CDFW California Species of Special Concern
Pacific Tailed Frog	*Ascaphus truei*	None	None	CDFW California Species of Special Concern
Birds				
Bald Eagle	*Haliaeetus leucocephalus*	Delisted	Endangered	Fully Protected
Bank Swallow	*Riparia riparia*	None	Threatened	None
Marbled Murrelet	*Brachyramphus marmoratus*	Endangered	Threatened	None
Northern Spotted Owl	*Strix occidentalis caurina*	Threatened	None	CDFW California Species of Special Concern
Western Snowy Plover	*Charadrius alexandrinus nivosus*	Threatened	None	CDFW California Species of Special Concern
Western Yellow-billed Cuckoo	*Coccyzus americanus*	Candidate	None	None
Fish				
Blue Chub	*Gila coerulea*	None	None	CDFW California Species of Special Concern (Class 2 - Special Concern)
Coastal Cutthroat Trout	*Oncorhynchus clarkii clarkii*	None	None	CDFW California Species of Special Concern (Class 2 - Special Concern) Forest Service Sensitive Species
Coho Salmon - Southern Oregon/Northern California ESU[1]	*Oncorhynchus kisutch*	Threatened	Threatened	CDFW California Species of Special Concern

Table 2. Sensitive Animal Species Potentially Present in the Vicinity of the AOC *(continued)*

Common Name	Scientific Name	Federal Status	California Status	Regulatory Agency Status
Fish *(continued)*				
Chinook Salmon - Southern Oregon/Northern California[1]	*Oncorhynchus tshawytscha*	Threatened	None	CDFW California Species of Special Concern (Class 1 - Endangered)
Chum Salmon	*Oncorhynchus keta*	Threatened	Endangered	CDFW California Species of Special Concern (Class 1 - Endangered)
Green Sturgeon	*Acipenser medirostris*	Threatened	None	CDFW California Species of Special Concern (Class 1 - Threatened)
Klamath Largescale Sucker	*Catostomus snyderi*	None	None	CDFW California Species of Special Concern (Class 2 - Special Concern)
Longfin Smelt	*Spirinchus thaleichthys*	None	Endangered	CDFW California Species of Special Concern (Class 1 - Endangered)
Lost River Sucker	*Deltistes luxatus*	Endangered	Endangered	None
Southern Eulachon DPS	*Thaleichthys pacificus*	Threatened	None	CDFW California Species of Special Concern (Class 3 - Watch List)
Steelhead Trout - Northern California ESU	*Oncorhynchus mykiss*	Threatened	None	None
Summer Steelhead	*Oncorhynchus mykiss irideus*	Threatened	None	CDFW California Species of Special Concern (Class 1 - Threatened)
Tidewater Goby	*Eucyclogobius newberryi*	Endangered	None	CDFW California Species of Special Concern (Class 1 - Endangered)
Insects				
Mardon Skipper	*Polites mardon*	Candidate	None	None
Oregon Silverspot Butterfly	*Speyeria zerene hippolyta*	Threatened	None	None

Table 2. Sensitive Animal Species Potentially Present in the Vicinity of the AOC *(continued)*

Common Name	Scientific Name	Federal Status	California Status	Regulatory Agency Status
Mammals				
Pacific Fisher	*Martes pennanti*	Candidate	None	CDFW California Species of Special Concern

Notes: Species status information collected from CDFW, NOAA, and U.S. Fish and Wildlife Service databases available online, respectively, at http://www.dfg.ca.gov/biogeodata/cnddb/, http://www.nmfs.noaa.gov/pr/, and http://www.fws.gov/.

Species list from California Natural Diversity Database Quick Viewer High Divide and Smith River quadrants available online at http://imaps.dfg.ca.gov/viewers/cnddb_quickviewer/app.asp.

1 = Identified during field surveys conducted within Copper Creek (Dames and Moore 1985)

CDFW = California Department of Fish and Wildlife

DPS = distinct population segment

ERRG = Engineering/Remediation Resources Group, Inc.

ESU = evolutionarily significant unit

NOAA = National Oceanic and Atmospheric Administration

Source: ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

Table 3. Sensitive Plant Species Potentially Present in the Vicinity of the AOC

Common Name	Scientific Name	Federal Status	California Status	Regulatory Agency Status
Canadian Buffalo-berry	*Shepherdia canadensis*	None	None	CNPS Rare, Threatened, or Endangered in California but more common elsewhere
Del Nort Pyrrocoma	*Pyrrocoma racemosa var. congesta*	None	None	CNPS Rare, Threatened, or Endangered in California but common elsewhere
Ghost Pipe	*Monotropa uniflora*	None	None	CNPS Rare, Threatened, or Endangered in California but common elsewhere
Great Burnet	*Sanguisorba officinalis*	None	None	CNPS Rare, Threatened, or Endangered in California but common elsewhere
Horned Butterwort	*Pinguicula macroceras*	None	None	CNPS Rare, Threatened, or Endangered in California but more common elsewhere
Howell's Fawn Lily	*Erythronium howellii*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Howell's Jewel-flower[1]	*Streptanthus howellii*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Howell's Sandwort	*Minuartia howellii*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Klamath Mountain buckwheat	*Eriogonum hirtellum*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Klamath Gentian	*Gentiana plurisetosa*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Little-leaved Huckleberry	*Vaccinium scoparium*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
McDonald's Rock Cress	*Arabis macdonaldiana*	Endangered	Endangered	CNPS Rare, Threatened, or Endangered in California and elsewhere

Table 3. Sensitive Plant Species Potentially Present in the Vicinity of the AOC *(continued)*

Common Name	Scientific Name	Federal Status	California Status	Regulatory Agency Status
Mendocino Gentian	*Gentiana setigera*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Opposite-leaved Lewisia	*Lewisia oppositifolia*	None	None	CNPS Rare, Threatened, or Endangered in California but common elsewhere
Pickering's Ivesia	*Ivesia pickeringii*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Sand Dune Phacelia	*Phacelia argentea*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Seacoast Ragwort	*Packera bolanderi var. bolanderi*	None	None	CNPS Rare, Threatened, or Endangered in California but common elsewhere
Seaside Pea	*Lathyrus japonicus*	None	None	CNPS Rare, Threatened, or Endangered in California but common elsewhere
Serpentine Catchfly	*Silene serpentinicola*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Serpentine Sedge	*Carex serpenticola*	None	None	CNPS Rare, Threatened, or Endangered in California but common elsewhere
Short-leaved Evax	*Hesperevax sparsiflora var. brevifolia*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Siskiyou Checkerbloom	*Sidalcea malviflora ssp. patula*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Siskiyou Paintbrush	*Castilleja miniata ssp. elata*	None	None	CNPS Rare, Threatened, or Endangered in California but common elsewhere
Small Groundcone	*Boschniakia hookeri*	None	None	CNPS Rare, Threatened, or Endangered in California but common elsewhere
Waldo Buckwheat[1]	*Eriogonum pendulum*	None	None	CNPS Rare, Threatened, or Endangered in California but common elsewhere

Table 3. Sensitive Plant Species Potentially Present in the Vicinity of the AOC *(continued)*

Common Name	Scientific Name	Federal Status	California Status	Regulatory Agency Status
Western Bog Violet[1]	*Viola primulifolia ssp. occidentalis*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere
Western Lily	*Lilium occidentale*	Endangered	Endangered	CNPS Rare, Threatened, or Endangered in California and elsewhere
Yellow Tubered Toothwort	*Cardamine nuttallii var. gemmata*	None	None	CNPS Rare, Threatened, or Endangered in California and elsewhere

Notes:

Species status information collected from CNPS database available online at http://www.cnps.org/cnps/rareplants/cnddb.php.

Species list generated from California Natural Diversity Database Quick Viewer High Divide and Smith River quadrants available online at http://imaps.dfg.ca.gov/viewers/cnddb_quickviewer/app.asp.

1 = Identified during field surveys conducted within Copper Creek (Dames and Moore 1985)

CNPS = California Native Plant Society

ERRG = Engineering/Remediation Resources Group, Inc.

Source: ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

Table 4. Metals Results for Waste Rock Samples

Sample ID No.	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium[1] (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
MM-WP-1	8.3	42	<1.9	<0.38	<0.48	970	65	32,000	35	0.34	<1.9	610	52	8.4	<1.9	23	86
MM-WP-2	4.3	45	2.7	<0.38	<0.47	600	86	5,200	3.8	0.26	<1.9	1,200	11	2.4	<1.9	12	64
MM-WP-3	4.1	110	<1.9	<0.37	<0.47	590	78	6,700	4.6	0.43	<1.9	1,400	9	7.5	<1.9	16	73
MM-WP-4	6.4	5.5	4.6	<0.38	<0.48	680	130	11	<1.9	0.043	<1.9	2,300	<3.8	<0.95	<1.9	25	31

Notes:

Source: ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

[1]Samples were analyzed for total chromium.

< = not detected above the method detection limit

ERRG = Engineering/Remediation Resources Group, Inc.

ID = identification

mg/kg = milligrams per kilogram

Table 5. Metals Results for Sediment Samples

Sample ID No.	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium[1] (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
MM-SD-2	8.7	12	9.7	<0.39	<0.49	1,400	130	95	<2	0.018	<2	2,300	<3.9	<0.98	<2	42	46
MM-SD-3	14	21	19	<0.38	<0.48	2,400	350	120	2.7	0.014	<1.9	4,000	<3.8	<0.95	<1.9	65	73

Notes:

Source: ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

[1]Samples were analyzed for total chromium.

< = not detected above the method detection limit

ERRG = Engineering/Remediation Resources Group, Inc.

ID = identification

mg/kg = milligrams per kilogram

Table 6. Metals Results for Surface Water Samples

Sample ID No.	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium[1] (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Molybdenum (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)
MM-SW-2	<0.01	<0.01	0.063	<0.002	<0.0025	<0.01	<0.002	<0.0015	<0.005	<0.0002	<0.01	0.02	<0.02	<0.005	<0.01	<0.01	<0.02
MM-SW-3	<0.01	<0.01	0.039	<0.002	<0.0025	<0.01	<0.002	<0.0015	<0.005	<0.0002	<0.01	0.019	<0.02	<0.005	<0.01	<0.01	<0.02

Notes:
Source: ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

[1]Samples were analyzed for total chromium
µg/L = micrograms per liter
< = not detected above the method detection limit
ERRG = Engineering/Remediation Resources Group, Inc.
ID = identification
mg/kg = milligrams per kilogram

Table 7. Leachability and Waste Characterization Results

	SPLP West		TTLC[1]				WET			TCLP			
Sample ID No.	Arsenic (mg/L)	Copper (mg/L)	Arsenic (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Selenium (mg/kg)	Arsenic (mg/L)	Chromium (mg/L)	Selenium (mg/L)	Arsenic (mg/L)	Chromium (mg/L)	Selenium (mg/L)	Waste Classification
MM-WP-01	<0.2	<0.2	42	970	**32,000**	52	- -	<0.77[2]	<0.05	- -	<0.25	<0.50	California Hazardous Waste (non-RCRA)
MM-WP-02	<0.2	<0.2	45	600	**5,200**	11	- -	2.9[2]	<0.5	- -	<0.25	- -	California Hazardous Waste (non-RCRA)
MM-WP-03	<0.2	<0.2	110	590	**6,700**	9	<0.25	**9.6**[2]	- -	<0.25	<0.25	- -	California Hazardous Waste (non-RCRA)
TTLC	NA	NA	500	2,500	2,500	100	NA	NA	NA	NA	NA	NA	
STLC	NA	NA	NA	NA	NA	NA	5	5[3]	1	NA	NA	NA	
MCCTC	NA	NA	NA	NA	NA	NA	NA	NA	NA	5	5	5	

Notes:

Bold text indicates concentration exceeds regulatory threshold for TTLC, STLC or MCCTC

All results analyzed by EPA Method 6010B.

[1] TTLC Results from samples collected and analyzed during the 2012 PA/SI (ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May)

[2] Samples were analyzed for total chromium

[3] Chromium VI comparison criteria selected for evaluation of total chromium for landfill acceptance

-- = not analyzed

EPA = U. S. Environmental Protection Agency

ERRG = Engineering/Remediation Resources Group, Inc.

ID No. = Identification number

MCCTC = maximum contaminant concentration for the toxicity characteristic (regulatory threshold for TCLP results)

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

NA = not applicable

RCRA = Resource Conservation and Recovery Act

SPLP West = synthetic precipitation leaching procedure for a western climate

STLC = soluble threshold concentration limit (regulatory threshold for WET results)

TCLP = Toxicity Characteristic Leaching Procedure

TTLC = Total Threshold Limit Concentration

WET = Waste Extraction Test

< = not detected at concentration less than reporting limit

Table 8. Screening of Metals in Waste Rock Samples

Sample ID No.	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium[1] (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
MM-WP-1	**8.3**	**42**	<1.9	<0.38	<0.48	970	65	**32,000**	**35**	**0.34**	<1.9	610	**52**	**8.4**	<1.9	23	**86**
MM-WP-2	4.3	**45**	2.7	<0.38	<0.47	600	86	**5,200**	3.8	**0.26**	<1.9	1,200	**11**	**2.4**	<1.9	12	**64**
MM-WP-3	4.1	**110**	<1.9	<0.37	<0.47	590	78	**6,700**	4.6	**0.43**	<1.9	1,400	**9**	**7.5**	<1.9	16	**73**
MM-WP-4	**6.4**	5.5	4.6	<0.38	<0.48	680	130	11	<1.9	**0.043**	<1.9	2,300	<3.8	<0.95	<1.9	25	31
Maximum Detected Concentration	8.3	110	4.6	ND	ND	970	130	32,000	35	0.43	ND	2,300	52	8.4	ND	25	86
Average Background[2]	5.4	8	30	0.5	<0.039 to <0.5	1403	233	15	5	0.02	<0.14 to <5.2	2,845	8	<0.03 to <10	6	40	60
Retained as COPC?	**Yes**	**Yes**	No	No	No	No	No	**Yes**	**Yes**	**Yes**	No	No	**Yes**	**Yes**	No	No	**Yes**
Human Health Criteria and COC Determination																	
RMC for Camper[3]	50	20	- -	- -	- -	- -	- -	5,000	1,000	40	- -	- -	700	700	- -	- -	40,000
RSL for industrial soil[4]	NA	NA	- -	- -	- -	- -	- -	NA	NA	NA	- -	- -	NA	NA	- -	- -	NA
Human health COC?	No	**Yes**	- -	- -	- -	- -	- -	**Yes**	No	No	- -	- -	No	No	- -	- -	No
BLM Risk Interpretation[5]	Low	**Moderate**	- -	- -	- -	- -	- -	**Moderate**	Low	Low	- -	- -	Low	Low	- -	- -	Low
Ecological Criteria and COC Determination																	
RMC for Wildlife and Livestock (median)[6]	NE	275	- -	- -	- -	- -	- -	136	125	8	- -	- -	NE	NE	- -	- -	307
Eco-SSL (Avian)[7]	NE	NA	- -	- -	- -	- -	- -	NA	NA	NA	- -	- -	1.2	4.2	- -	- -	NE
Eco-SSL (Inverts)[7]	78	NA	- -	- -	- -	- -	- -	NA	NA	NA	- -	- -	4.1	NE	- -	- -	NE
Eco-SSL (Mammals)[7]	0.27	NA	- -	- -	- -	- -	- -	NA	NA	NA	- -	- -	0.63	14	- -	- -	NE
Eco-SSL (Plants)[7]	NE	NA	- -	- -	- -	- -	- -	NA	NA	NA	- -	- -	0.52	560	- -	- -	NE
Ecological COC?[8]	**Yes**	No	- -	- -	- -	- -	- -	**Yes**	No	No	- -	- -	**Yes**	**Yes**	- -	- -	No
BLM Risk Interpretation[5]	**High**	Low	- -	- -	- -	- -	- -	**Extremely High**	Low	Low	- -	- -	**High**	**Moderate**	- -	- -	Low

Notes:

Source: ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

Bold concentrations exceed the background concentration.

Red concentrations exceed human health criteria.

Shaded concentrations exceed ecological criteria.

[1]Samples were analyzed for total chromium

[2]Background rationale and calculations are provided in Appendix D.

[3]U.S. Department of Interior BLM human RMC for the camper (2004)

[4]EPA, 2013. "Regional Screening Levels (Formerly PRGs)." November. Available Online at <http://www.epa.gov/region09/superfund/prg>.

[5]Based on the comparison of maximum detected concentrations and BLM RMCs; BLM (2004) risk interpretation is as follows:

Low Risk = Concentration less than the criteria

Moderate Risk = Concentration 1 to 10 times higher than the criteria

High Risk = Concentration 10 to 100 times higher than the criteria

Extremely High Risk = Concentration greater than 100 times the criteria

[6]U.S. Department of Interior BLM median wildlife and livestock RMC (2004)

[7]EPA, 2005. "Guidance for Developing Ecological Soil Screening Levels." Office of Solid Waste and Emergency Response. February.

[8]Lowest screening criteria used in the risk evaluation

- - = not evaluated; maximum detected concentration does not exceed representative background concentration; therefore, the metal is not a human health or ecological COC

< = not detected above the method detection limit

BLM = Bureau of Land Management

COC = contaminant of concern

COPC = chemical of potential concern

Eco-SSL = ecological soil screening level

EPA = U.S. Environmental Protection Agency

ERRG = Engineering/Remediation Resources Group, Inc.

ID = Identification

mg/kg = milligrams per kilogram

NA = not applicable; if BLM RMC available, other screening levels not listed in table

ND = not detected above method reporting limit

NE = screening level not established

RMC = Risk Management Criteria

RSL = Regional Screening Level

Table 9. Screening of Metals in Sediment Samples

Sample ID No.	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium[1] (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
MM-SD-2	8.7	12	9.7	<0.39	<0.49	1,400	130	**95**	<2	0.018	<2	2,300	<3.9	<0.98	<2	42	46
MM-SD-3	**14**	**21**	19	<0.38	<0.48	**2,400**	**350**	**120**	**2.7**	0.014	<1.9	**4,000**	<3.8	<0.95	<1.9	**65**	**73**
Maximum Detected Concentration	14	21	19	ND	ND	2,400	350	120	2.7	0.018	ND	4,000	ND	ND	ND	65	73
Background (Sample MM-SD-1)	11	16	20	<0.37	<0.46	1,800	260	13	2	0.018	<1.8	3,000	<3.7	<0.92	1.9	53	61
Retained as COPC	**Yes**	**Yes**	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	No	No	**Yes**	No	No	No	**Yes**	**Yes**
Human Health Criteria and COC Determination																	
RMC for Camper[2]	62	46	- -	- -	- -	NE	NE	5,745	1,000	- -	- -	3,094	- -	- -	- -	NE	46,455
RSL for industrial soil[3]	NA	NA	- -	- -	- -	1,500,000	300	NA	NA	- -	- -	NA	- -	- -	- -	5,100	NA
Human Health COC?	No	No	- -	- -	- -	No	Yes	No	No	- -	- -	Yes	- -	- -	- -	No	No
BLM Risk Interpretation[4]	Low	Low	- -	- -	- -	Low	**Moderate**	Low	Low	- -	- -	**Moderate**	- -	- -	- -	Low	Low
Ecological Criteria and COC Determination																	
NOAA Threshold Effects Level (freshwater)[5]	3.0	5.9	- -	- -	- -	37.3	50	35.7	35	- -	- -	18	- -	- -	- -	NE	123
Ecological COC?	**Yes**	**Yes**	- -	- -	- -	**Yes**	**Yes**	**Yes**	No	- -	- -	**Yes**	- -	- -	- -	**Yes**	No
BLM Risk Interpretation[4]	**Moderate**	**Moderate**	- -	- -	- -	**High**	**Moderate**	**Moderate**	Low	- -	- -	**Extremely High**	- -	- -	- -	**NE[6]**	Low

Notes:

Source: ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

Bold concentrations exceed the background concentration.

Red concentrations exceed human health criteria.

Shaded concentrations exceed ecological criteria.

[1]Samples were analyzed for total chromium

[2]U.S. Department of Interior BLM human RMC for the camper (2004)

els (Formerly PRGs)." November. Available Online at <http://www.epa.gov/region09/superfund/prg>.

[4]Based on the comparison of maximum detected concentrations and BLM RMCs; BLM (2004) risk interpretation is as follows:

Low Risk = Concentration less than the criteria

Moderate Risk = Concentration 1 to 10 times higher than the criteria

High Risk = Concentration 10 to 100 times higher than the criteria

Extremely High Risk = Concentration greater than 100 times the criteria

[5]Buchman, M.F., 2008. "NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1." Office of Response and Restoration Division, National Oceanic and Atmospheric Administration. Seattle, Washington. Available Online at: <http://www.gesamp.org/data/gesamp/files/file_element/4a2a322c8acb2c26cc0234685eac71fa/SQuiRTs.pdf>

[6]No known ecological sediment screening values available for vanadium

- - = not evaluated; maximum detected concentration does not exceed representative background concentration; therefore, the metal is not a human health or ecological COC

< = not detected above the method detection limit

BLM = Bureau of Land Management

COC = contaminant of concern

COPC = chemical of potential concern

EPA = U.S. Environmental Protection Agency

ERRG = Engineering/Remediation Resources Group, Inc.

ID = Identification

mg/kg = milligrams per kilogram

NA = not applicable; if BLM RMC available, other screening levels not listed in table

ND = not detected above method reporting limit

NE = screening level not established

NOAA = National Oceanic and Atmospheric Administration

RMC = Risk Management Criteria

RSL = Regional Screening Level

Table 10. Screening of Metals in Surface Water Samples

Sample ID No.	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium[1] (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Molybdenum (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)
MM-SW-2	<0.01	<0.01	0.063	<0.002	<0.0025	<0.01	<0.002	<0.0015	<0.005	<0.0002	<0.01	0.02	<0.02	<0.005	<0.01	<0.01	<0.02
MM-SW-3	<0.01	<0.01	0.039	<0.002	<0.0025	<0.01	<0.002	<0.0015	<0.005	<0.0002	<0.01	0.019	<0.02	<0.005	<0.01	<0.01	<0.02
Maximum Detected Concentration	ND	ND	0.063	ND	ND	ND	ND	ND	ND	ND	ND	0.02	ND	ND	ND	ND	ND
Background (sample MM-SW-1)	<0.01	<0.01	0.064	<0.002	<0.0025	<0.01	<0.002	<0.0015	<0.005	<0.0002	<0.01	0.02	<0.02	<0.005	<0.01	<0.01	<0.02
Retained as COPC?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Notes:

Source: ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

[1]Samples were analyzed for total chromium

< = not detected above the method detection limit

µg/L = micrograms per liter

COPC = chemical of potential concern

ERRG = Engineering/Remediation Resources Group, Inc.

ID = Identification

ND = not detected above method reporting limit

Table 11. Federal Chemical-Specific ARARs

Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Bevill Amendment, § 3001(a)(3)(A)(ii), 42 USC, § 6921(a)(3)(A)(ii)[1]				
Excludes from hazardous waste classification solid waste from the extraction, beneficiation, and processing of ores and minerals	Mining waste from extraction exempt from Subtitle C of RCRA	40 CFR §261.4(b)(7)	Applicable	Mine waste piles at the AOC are from the extraction of minerals. Therefore, they do not warrant regulation as hazardous waste and are not subject to RCRA Subtitle C regulation.

Notes:

1 = Statutes and policies are provided as headings to identify general categories of potential ARARs. Only pertinent substantive requirements of the specific citations are considered potential ARARs.

ARARs = applicable or relevant and appropriate requirements

CFR = *Code of Federal Regulations*

RCRA = Resource Conservation and Recovery Act

USC = *United States Code*

§ =Section

Table 12. Federal Location-Specific ARARs

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Endangered Species Act of 1973[1]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat	Determination of effect upon endangered or threatened species or associated habitat; critical habitat upon which endangered or threatened species depend	16 USC § 1536(a),(h)(1)(B)	Applicable	The AOC contains habitat used by several federally listed species (see Tables 2 and 3 of this EE/CA). Before any removal action, a biological evaluation may be required to determine the potential for adverse effects or harm to any listed species or the destruction or adverse modification of in-stream aquatic habitats along and downstream of the section of the unnamed tributary within the AOC.
Migratory Bird Treaty Act of 1972[1]					
Migratory bird area	Protects almost all species of native migratory birds in the United States from unregulated "take"	Presence of migratory birds	16 USC § 703	Relevant and appropriate	To date, no migratory birds have been identified at the AOC. Compliance with this act will be required if migratory birds are identified.
Magnuson-Stevens Fishery Conservation and Management Act of 1976, as Amended[1]					
Fishery under management	Provides for conservation and management of specified fisheries within specified fishery conservation zones	Presence of managed fisheries	16 USC §§ 1801–1882	Relevant and appropriate	AOC actions will be evaluated for potential adverse effects or harm to managed fisheries downstream from the AOC. To date, surface water at the AOC has not been identified as a medium of concern.

Table 12. Federal Location-Specific ARARs *(continued)*

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
National Historic Preservation Act of 1966, as Amended[1]					
Federal land	Establishes a program for the preservation of historic federal properties within the United States	Property included in or eligible for the National Register of Historic Places	16 USC § 470–470x-6, 36 CFR 800, and 40 CFR § 6.301(b)	Applicable	Remaining structures within the boundary of the AOC may be classified as being of historic importance.
Archaeological and Historic Preservation Act[1]					
Federal land	Establishes procedures to provide for preservation of historical and archeological data that could be destroyed through alteration of terrain resulting from a federal construction project or federally licensed activity or program	Federal construction project or federally licensed activity or program	16 USC § 469–469(c)(1) and 40 CFR § 6.301(c)	Applicable	Compliance with this act will be required if archaeological resources are identified. If any removal action would cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archaeological data, it would be necessary to follow the procedures in the statute to provide for data recovery and preservation activities.
Copper Creek 2012 Level II Stream Survey[1]					
Copper Creek	Documents the condition of Copper Creek and its tributaries.	Location of portions of the AOC within Copper Creek	"Copper Creek 2012 Level II Stream Survey" prepared by W. Scott Bowman, September 2013	TBC	This document will be used to help maintain the creek through the construction process at the same standard as before construction.

Table 12. Federal Location-Specific ARARs *(continued)*

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Archaeological Resources Protection Act of 1979, as Amended[1]					
Public lands	Prohibits unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources located on public lands unless such action is conducted pursuant to a permit.	Archaeological resources on federal land	Public Law No. 96-95 and 16 USC § 470aa–470mm	Applicable	Compliance with this act would be required if archaeological resources are identified. If any removal action would cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archaeological data, it would be necessary to follow the procedures in the statute to provide for data recovery and preservation activities.
Smith River National Recreation Act[1]					
Smith River and tributaries	Improve anadromous fishery and water quality, including improving fish spawning and rearing habitat, and placing appropriate restrictions or limitations on soil-disturbing activities; provide for the restoration of landscapes damaged by past human activity consistent with the purposes of the act	Smith River Recreation Area designated as national recreation area	16 USC §§ 460bbb	Applicable	The AOC lies on along the banks of a tributary to Copper Creek, a tributary to the Smith River.

Table 12. Federal Location-Specific ARARs *(continued)*

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Wild and Scenic River Act, 16 USC §§ 1271-1287, October 2, 1968, as Amended[1]					
Designated portions of the Smith River and its tributaries	Establishes National Wild and Scenic Rivers System to protect rivers with important scenic, recreational, fish and wildlife, and other values; rivers classified as wild, scenic, or recreational; includes procedures and limitations for control of lands in federally administered components of the System and for disposition of lands and minerals under federal ownership	Area designated as wild and scenic	16 USC § 1274(a)(111)	Applicable	The act designates the Smith River as wild and scenic from the confluence of the Middle and North Forks to the Six Rivers National Forest boundary, including Rowdy Creek from the California-Oregon State line to the National Forest boundary. The AOC is located along a tributary to Copper Creek, which is a tributary to Rowdy Creek. Therefore, the wild and scenic designation applies to the AOC.

Table 12. Federal Location-Specific ARARs *(continued)*

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
USDA Forest Service Land Management Plan Standards and Guides and National Recreation Area Act Provisions[1]					
Smith River National Recreation Area of the Six Rivers National Forest	Establishes standards and guides for the national recreation area, including restrictions on solid and sanitary waste facilities in riparian reserves, requirements for watershed habitat restoration, and the following aquatic conservation strategy objectives: ▪ Maintain and restore physical integrity of the aquatic system, including shorelines, banks, and bottom configurations ▪ Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems ▪ Maintain and restore sediment regime under which aquatic ecosystems evolved ▪ Watershed habitat restoration requirements prohibit mitigation as a substitute for preventing habitat degradation	Management direction from the Six Rivers Land and Resource Management Plan and the Smith River National Recreation Area Act	Riparian Management Standards and Statutes for Copper Creek CERCLA Mine Tailing Abatement, Management Direction from Six Rivers Land and Resource Management Plan, and Smith River National Recreation Area Act Provisions (USDA Forest Service, undated)	TBC	Standards and guides established for the Smith River National Recreation Area that are not otherwise promulgated will be used as guidance in selecting and implementing the removal action at the AOC.

Table 12. Federal Location-Specific ARARs *(continued)*

Notes:

1 = Statutes and policies are provided as headings to identify general categories of potential ARARs. Only pertinent substantive requirements of the specific citations are considered potential ARARs.

ARARs = applicable or relevant and appropriate requirements

CFR = *Code of Federal Regulations*

EE/CA = Engineering Evaluation/Cost Analysis

TBC = to be considered

USC = *United States Code*

USDA = U.S. Department of Agriculture

§ = Section

§§ = Sections

Table 13. Federal Action-Specific ARARs

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Clean Water Act, as Amended[1]					
Construction activities	Establishes the structure for regulating discharges of pollutants to waters of the United States and regulating quality standards for surface waters; establishes limitations, standards, and other permit conditions; SWRCB Order 99-08-DWQ, developed pursuant to these requirements sets forth requirements for all construction activity in the State of California (except for Tribal Lands, the Lake Tahoe Hydrologic Unit, and activity performed by the California Department of Transportation)	Construction activities at least 1 acre in size	Clean Water Act, 33 USC §1251 et seq. (1972), and 40 CFR § 122.44(k)(2) and (4) (SWRCB Water Quality Order 99-08-DWQ adopted pursuant)	Applicable	The Clean Water Act is applicable to all construction activities. For alternatives that will disturb more than 1 acre, compliance with the following substantive requirements of the State's General Permit (SWRCB Order 99-08-DWQ) is required: ▪ Develop and implement a storm water pollution prevention plan specifying BMPs to protect storm water ▪ Establish measures to eliminate non-storm discharges ▪ Specify BMP inspection requirements

Table 13. Federal Action-Specific ARARs *(continued)*

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Native American Graves Protection and Repatriation Act[1]					
Excavation and ground disturbance	Requires that Native American graves not be disturbed and that, if discovered, excavation and ground disturbance would be stopped	Excavation and ground-disturbing activities	25 USC §3 001 et seq. and 43 CFR, Part 10	Relevant and appropriate	This act protects Native American graves from desecration through the removal and trafficking of human remains and cultural items, including funerary and sacred objects. To protect Native American burials and cultural items, the regulations require that, if such items are inadvertently discovered during excavation, the excavation must cease and the affiliated tribes must be notified and consulted. The provisions of the act apply to ground-disturbing activities such as soil grading and removal.
American Indian Religious Freedom Act[1]					
Excavation and ground disturbance	Protects Native American traditional religious rights and cultural practices, including access to sacred sites, freedom to worship through ceremonial and traditional rights, and use and possession of objects considered sacred	Excavation and ground-disturbing activities	42 USC § 1996 et seq.	Relevant and appropriate	This act requires that excavation and soil grading have no negative impact on the free practice of religion by Native American groups. If sacred sites are discovered in the course of soil disturbances, work would be stopped and appropriate notifications made.

Table 13. Federal Action-Specific ARARs *(continued)*

Notes:

1 = Statutes and policies are provided as headings to identify general categories of potential ARARs. Only pertinent substantive requirements of the specific citations are considered potential ARARs.

ARARs = applicable or relevant and appropriate requirements

BMPs = best management practices

CFR = *Code of Federal Regulations*

SWRCB = State Water Resources Control Board

USC = *United States Code*

§ = Section

Table 14. State Action-Specific ARARs

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments and Compliance Measures
Water Board Draft Basin Plan Amendment[1]					
Earth-disturbing construction activities	Proposed Basin Plan amendment that prohibits the discharge of excess sediment; amendment necessary to comply with 23 CCR § 2915	Anthropogenic activities that could result in a discharge of excess sediment	Draft Measures to Reduce Excess Sediment, SWRCB, July 18, 2007	TBC	The draft measures are TBC in the development of design documents for the selected removal action.
California Mining Waste Regulations Pursuant to California Water Code § 13172[1]					
Onsite encapsulation of mining waste	Addresses the management of mining waste; contains specific requirements on siting, construction, monitoring, and closure and post-closure maintenance of existing and new units	Mining waste	27 CCR §§ 22470–22510	Relevant and appropriate	The regulations establish the following three groups of mining waste: Group A – mining waste that must be managed as hazardous waste provided the Water Board finds that such mining wastes pose a significant threat to water quality Group B – mining wastes that consist of or contain hazardous wastes that qualify for a variance, provided that the Water Board finds that such mining wastes pose a low risk to water quality, or mining wastes that consist of or contain non-hazardous soluble pollutants at concentrations that exceed water quality objectives for or could cause degradation of waters of the State. Group C – wastes from which any discharge would be in compliance with the applicable water quality control plan, including water quality objectives other than turbidity Classification of mining waste as hazardous under the Hazardous Waste Control Act is used to determine which group designation is appropriate. Mining wastes at the Site may be classified as either Group B or C waste, depending on hazardous characteristics and the level of threat to water quality. These requirements are ARARs for alternatives that involve an onsite encapsulation unit.

Table 14. State Action-Specific ARARs *(continued)*

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments and Compliance Measures
California Air Resources Board, Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations[1]					
Construction and grading	Stabilization and monitoring required when ultramafic or serpentinite soils are disturbed by construction or grading activities	Disturbance of ultramafic or serpentinite soil	17 CCR § 93105	Applicable	This measure applies to construction activities that disturb serpentinite soil. Wetting or other stabilization is required as well as adequate air monitoring and personal protective equipment.
North Coast Unified Air Quality Management District[1]					
Excavation and handling of contaminated soil	Prohibits discharge of hazardous materials to through fugitive dust, and adopts the NESHAP	Disturbance of contaminated soil	Rule 104 Prohibitions	TBC	This non-promulgated rule prohibits the discharge of material that causes injury, detriment, or nuisance to the public. It prohibits unnecessary amounts of particulate matter from becoming airborne and requires that reasonable precautions be taken to prevent particulate matter from becoming airborne.

Notes:

1 = Statutes and policies are provided as headings to identify general categories of potential ARARs. Only pertinent substantive requirements of the specific citations are considered potential ARARs.

ARARs = applicable or relevant and appropriate requirements

Basin Plan = Water Quality Control Plan for the North Coast Region

CCR = *California Code of Regulations*

NESHAP = National Emission Standards for Hazardous Air Pollutants

SWRCB = State Water Resources Control Board

TBC = to be considered

Water Board = North Coast Regional Water Quality Control Board

§ = Section

§§ = Sections

Table 15. Summary of Response Action Screening

Response Action	Technology and Process	Description	Screening Summary
1. No Action	None	None	Retained; required by CERCLA
2. Engineering Controls	▪ Encapsulate mine waste with a clean soil cover	▪ Excavate and consolidate mine waste for placement in onsite or nearby encapsulation unit ▪ Construct soil cap over encapsulation unit	Retained because: ▪ protective of human health and the environment and meets RAOs, ▪ effective and easily implementable, and ▪ reduces future risk of erosion into surface water pathway and potential contact of human and ecological receptors
3. Offsite Disposal of Mine Waste	▪ Remove mine waste for offsite disposal	▪ Excavate mine waste ▪ Load mine waste into dump trucks and transport to an off-Site disposal facility	Retained because: ▪ protective of human health and the environment and meets RAOs, ▪ effective and easily implementable ▪ reduces future risk of erosion into surface water pathway and potential contact of human and ecological receptors

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

RAOs = removal action objectives

Table 16. Comparative Analysis of Removal Action Alternatives

Evaluation Criteria	Alternative 1: No Action	Alternative 2: Removal and Onsite Encapsulation (at the AOC)	Alternative 3: Removal and Onsite Encapsulation (within the Altaville Mining District near the AOC)	Alternative 4: Removal and Offsite Disposal
Effectiveness	**Qualitative Ranking**			
Protection of Human Health and Environment	No	Yes	Yes	Yes
Compliance with ARARs	NA	Yes	Yes	Yes
Long-Term Effectiveness	Low	High	High	High
Short-Term Effectiveness	Low	High	High	High
Achievement of RAOs	No	Yes	Yes	Yes
Reduction of Toxicity, Mobility, or Volume through Treatment	Low	Low	Low	Low
Implementability	**Qualitative Ranking**			
Technical Feasibility	High	High	High	Moderate
Administrative Feasibility	High	High	High	High
Availability of Services or Materials	NA	High	High	High
Cost				
Period of Analysis (Years)	30	30	30	30
Estimated Capital Cost	$0	$673,000	$761,500	$875,200
Estimated Total O&M/Periodic Cost	$0	$26,400	$26,400	$2,000
Estimated Total Cost	$0	$699,400	$787,900	$877,200
Estimated Total Present Value	$0	$696,500	$785,000	$877,100
Cost Range (-30% to +50%)	$0	$487,550 - $1,044,750	$549,500 - $1,177,500	$613,970 - $1,315,650

Notes:

ARARs = applicable or relevant and appropriate requirements O&M = Operation and Maintenance RAO = removal action objective

Appendix A. Photographic Log

Photograph A-1: Facing south, Former loading platform and bulldozer cut above waste pile 3.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-2: Facing north, waste pile 3 from the loading platform.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-3: Facing north, Standing on waste rock pile 3 looking up to the former loading platform.

Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-4: Facing north, standing at the top of waste rock pile 3 looking down towards the creek.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-5: Facing north, standing at the top of waste rock pile 3 looking down towards the creek.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-6: Facing south, adit 3 opening.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-7: Facing northeast, waste rock pile 1
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-8: Facing west top of waste pile 1 looking towards the adit opening (opening not visible in center of frame)
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-9: Facing west across waste rock pile 1
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-10: Facing north down the ridge of waste rock pile 1 to the creek
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-11: Facing east, across waste rock pile 1.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-12: Facing north, adit 1 opening.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-13: Facing southwest, midway down waste pile 1 looking up and across the hill slope.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-14: Facing southwest, midway down waste pile 1 looking up and across the hill slope.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-15: Facing west, waste pile 1.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-16: Facing northwest, waste pile 1 down to creek.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-17: Facing south, from the bottom of waste pile 1 up the slope.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-18: Facing south, adit 2 opening.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-19: Facing south east, waste rock pile 2 (with backpacks).
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-20: Facing north, waste rock pile 2 down to the creek with ephemeral drainage at left of frame.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-21: facing west, across waste pile 2.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-22: facing south, up to the top of waste rock pile 2.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-23: Facing south, sparsely vegetated ridgeline access route to waste piles.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Photograph A-24: Facing southwest, waste rock pile 3.
Photographed by: Tiffany Angus (ERRG) Date: November 11, 2013

Appendix B. Field Activity Logs

Location _____ Date _____

Project / Client _____

Photo log

~~2420~~

1	S	loading dock + dozer cut
2	N	to pile 3 from Loading area
3	N	to loading dock from WRP3
4	S	WRP3 down to creek
5	S	" (closer talke to creek)
6	S	Adit at WP3
7	NE	WRP1
8	W	adit associated w/ WRP1 (from top of WRP2 looking down)
9	W	WRP1 (top)
10	N	WRP1 down to creek
11	E	WRP1
12	N	WRP1 adit
13	SW	WRP1 (up slopeside)
14	SW	WRP1 (up slopeside)
15	W	WRP1 direct west
16	NW	WRP1 (down to creek)
17	S	WRP1 up slope
18	W	WRP2 adit (gated)
19	SE	WRP2
20	N	WRP2 twd creek; drainage on L
21	W	WRP2
22	S	WRP2

WRP1 Not 2 tha

Location Mammoth Mine Sixrivers Forest Date 11/11/13

Project / Client EE/CA

Scale

1330 ~~1400~~ Parkt hike to MM site

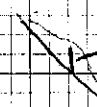
1400 ~~1500~~ arrive at MM site

1410 ~~1510~~ GPS + collect Sample at WP-3

1425 ~~1525~~ Largest pile 3 50 x 30

~10 ft at center

Slope under pile 3 planar



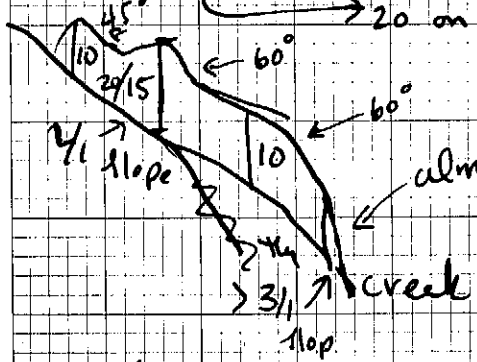
1439 - arrive @ WRP1

50 x 50 ft area; highest pt ~20 to 15 ft thick, average of 10 ft tall

20 on west side

15 to east side

native



gated adit - wet but not running water

1505 - arrive @ WRP2 collect sample @ 1510; GPS coords

20 x 22 ft wide; 5-8 at the thickest.

Location _____ Date _____

Project / Client _____

23 S ridgeline up to road (E of WRP3)

24 SW WRP3 from ridgeline

Hard Scrabble

1 N ore loading structure
2 W road
3 S WRP2 (other side of "path")
4 W road - loading dock on R, WRP2 on L
5 NW ore loading dock
6 SW lumber debris, WRP2
7 NE ore loading dock
8 S WRP1 from across creek
9 S WRP2 into creek (near ore structure)
10 NW cut + WRP2
11 W metal pipe + debris
~~12 NE~~ no photo 12
13 SE WRP1
14 SW WRP1
15 N ore loading structure + pile
16 NE "
17 NW cut + WRP2
18 SW metal debris, WRP1
19 E collapsed structure adjacent to WRP1
20 own shingles - possible ACM

Location Hard Scrabble Date 11/12/13

Project / Client USFS

Scale

0730 - mob to site from hotel

0815 - arrive at site + begin setting up sampling + GPS equipment. Start hike in.

0900 - arrive on site; begin collecting GPS data and photos.

HS-WP-01 @ 0900
HS-WP-02 @ 1000

do not collect additional WP samples because WRP2 is not distinctly divided into >1 pile (previous contractor identified several piles - however its one long pile).

Debris adjacent to WRP1 - 4 high sides (50 yards x 4) possible ACM in shingles/roofing material - collect sample.

1100 - finish up GPS + photos mob to truck @1120 — 40 min walk.

Appendix C. Laboratory Analytical Reports

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica San Francisco
1220 Quarry Lane
Pleasanton, CA 94566
Tel: (925)484-1919

TestAmerica Job ID: 720-38393-1
Client Project/Site: Mammoth Mine

For:
Engineering Remediation Resources Group.
4585 Pacheco Boulevard
Suite 200
Martinez, California 94553-2233

Attn: Ms. Samantha C Knight

Authorized for release by:
11/4/2011 4:58:51 PM

Dimple Sharma
Project Manager I
dimple.sharma@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Definitions/Glossary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Qualifiers

Metals

Qualifier	Qualifier Description
F	MS or MSD exceeds the control limits
4	MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.
F	RPD of the MS and MSD exceeds the control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Job ID: 720-38393-1

Laboratory: TestAmerica San Francisco

Narrative

Job Narrative
720-38393-1

Comments
No additional comments.

Receipt
All samples were received in good condition within temperature requirements.

Metals
Method 6010B: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for prep batch 102081 were outside control limits. The associated laboratory control sample (LCS) recovery met acceptance criteria.

Method 7471A: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for prep batch 102065 were outside control limits. The associated laboratory control sample (LCS) recovery met acceptance criteria.

No other analytical or quality issues were noted.

General Chemistry
No analytical or quality issues were noted.

Detection Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-SW-1 — Lab Sample ID: 720-38393-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.064		0.0050		mg/L	1		6010B	Total/NA
Calcium	0.89		0.20		mg/L	1		6010B	Total/NA
Nickel	0.020		0.010		mg/L	1		6010B	Total/NA
Magnesium	28		0.20		mg/L	1		6010B	Total/NA
Hardness	120		1.9		mg/L	1		SM 2340B	Total/NA

Client Sample ID: MM-SW-2 — Lab Sample ID: 720-38393-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.063		0.0050		mg/L	1		6010B	Total/NA
Calcium	0.90		0.20		mg/L	1		6010B	Total/NA
Nickel	0.020		0.010		mg/L	1		6010B	Total/NA
Magnesium	29		0.20		mg/L	1		6010B	Total/NA
Hardness	120		1.9		mg/L	1		SM 2340B	Total/NA

Client Sample ID: MM-SW-3 — Lab Sample ID: 720-38393-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.039		0.0050		mg/L	1		6010B	Total/NA
Calcium	0.91		0.20		mg/L	1		6010B	Total/NA
Nickel	0.019		0.010		mg/L	1		6010B	Total/NA
Magnesium	28		0.20		mg/L	1		6010B	Total/NA
Hardness	120		1.9		mg/L	1		SM 2340B	Total/NA

Client Sample ID: MM-SD-1 — Lab Sample ID: 720-38393-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	11		1.8		mg/Kg	4		6010B	Total/NA
Arsenic	16		3.7		mg/Kg	4		6010B	Total/NA
Barium	20		1.8		mg/Kg	4		6010B	Total/NA
Chromium	1800		1.8		mg/Kg	4		6010B	Total/NA
Cobalt	260		0.73		mg/Kg	4		6010B	Total/NA
Copper	13		5.5		mg/Kg	4		6010B	Total/NA
Lead	2.0		1.8		mg/Kg	4		6010B	Total/NA
Nickel	3000		1.8		mg/Kg	4		6010B	Total/NA
Thallium	1.9		1.8		mg/Kg	4		6010B	Total/NA
Vanadium	53		1.8		mg/Kg	4		6010B	Total/NA
Zinc	61		5.5		mg/Kg	4		6010B	Total/NA
Mercury	0.018		0.0088		mg/Kg	1		7471A	Total/NA
Analyte	**Result**	**Qualifier**	**RL**	**RL**	**Unit**	**Dil Fac**	**D**	**Method**	**Prep Type**
pH	7.81		0.100		SU	1		9045C	Soluble

Client Sample ID: MM-SD-2 — Lab Sample ID: 720-38393-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	8.7		2.0		mg/Kg	4		6010B	Total/NA
Arsenic	12		3.9		mg/Kg	4		6010B	Total/NA
Barium	9.7		2.0		mg/Kg	4		6010B	Total/NA
Chromium	1400		2.0		mg/Kg	4		6010B	Total/NA
Cobalt	130		0.78		mg/Kg	4		6010B	Total/NA
Copper	95		5.9		mg/Kg	4		6010B	Total/NA
Nickel	2300		2.0		mg/Kg	4		6010B	Total/NA
Vanadium	42		2.0		mg/Kg	4		6010B	Total/NA

Client Sample ID: MM-SD-2 (Continued) — Lab Sample ID: 720-38393-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Zinc	46		5.9		mg/Kg	4		6010B	Total/NA
Mercury	0.018		0.0097		mg/Kg	1		7471A	Total/NA

Analyte	Result	Qualifier	RL	RL	Unit	Dil Fac	D	Method	Prep Type
pH	7.87		0.100		SU	1		9045C	Soluble

Client Sample ID: MM-SD-3 — Lab Sample ID: 720-38393-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	14		1.9		mg/Kg	4		6010B	Total/NA
Arsenic	21		3.8		mg/Kg	4		6010B	Total/NA
Barium	19		1.9		mg/Kg	4		6010B	Total/NA
Chromium	2400		1.9		mg/Kg	4		6010B	Total/NA
Cobalt	350		0.76		mg/Kg	4		6010B	Total/NA
Copper	120		5.7		mg/Kg	4		6010B	Total/NA
Lead	2.7		1.9		mg/Kg	4		6010B	Total/NA
Nickel	4000		1.9		mg/Kg	4		6010B	Total/NA
Vanadium	65		1.9		mg/Kg	4		6010B	Total/NA
Zinc	73		5.7		mg/Kg	4		6010B	Total/NA
Mercury	0.014		0.0097		mg/Kg	1		7471A	Total/NA

Analyte	Result	Qualifier	RL	RL	Unit	Dil Fac	D	Method	Prep Type
pH	8.17		0.100		SU	1		9045C	Soluble

Client Sample ID: MM-WP-1 — Lab Sample ID: 720-38393-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	8.3		1.9		mg/Kg	4		6010B	Total/NA
Arsenic	42		3.8		mg/Kg	4		6010B	Total/NA
Chromium	970		1.9		mg/Kg	4		6010B	Total/NA
Cobalt	65		0.77		mg/Kg	4		6010B	Total/NA
Copper	32000		140		mg/Kg	100		6010B	Total/NA
Lead	35		1.9		mg/Kg	4		6010B	Total/NA
Nickel	610		1.9		mg/Kg	4		6010B	Total/NA
Selenium	52		3.8		mg/Kg	4		6010B	Total/NA
Silver	8.4		0.96		mg/Kg	4		6010B	Total/NA
Vanadium	23		1.9		mg/Kg	4		6010B	Total/NA
Zinc	86		5.8		mg/Kg	4		6010B	Total/NA
Mercury	0.34		0.0095		mg/Kg	1		7471A	Total/NA

Analyte	Result	Qualifier	RL	RL	Unit	Dil Fac	D	Method	Prep Type
pH	5.34		0.100		SU	1		9045C	Soluble

Client Sample ID: MM-WP-2 — Lab Sample ID: 720-38393-8

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	4.3		1.9		mg/Kg	4		6010B	Total/NA
Arsenic	45		3.8		mg/Kg	4		6010B	Total/NA
Barium	2.7		1.9		mg/Kg	4		6010B	Total/NA
Chromium	600		1.9		mg/Kg	4		6010B	Total/NA
Cobalt	86		0.75		mg/Kg	4		6010B	Total/NA
Copper	5200		5.7		mg/Kg	4		6010B	Total/NA
Lead	3.8		1.9		mg/Kg	4		6010B	Total/NA
Nickel	1200		1.9		mg/Kg	4		6010B	Total/NA
Selenium	11		3.8		mg/Kg	4		6010B	Total/NA
Silver	2.4		0.94		mg/Kg	4		6010B	Total/NA

Detection Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-WP-2 (Continued) — Lab Sample ID: 720-38393-8

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Vanadium	12		1.9		mg/Kg	4		6010B	Total/NA
Zinc	64		5.7		mg/Kg	4		6010B	Total/NA
Mercury	0.26		0.0094		mg/Kg	1		7471A	Total/NA

Analyte	Result	Qualifier	RL	RL	Unit	Dil Fac	D	Method	Prep Type
pH	6.01		0.100		SU	1		9045C	Soluble

Client Sample ID: MM-WP-3 — Lab Sample ID: 720-38393-9

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	4.1		1.9		mg/Kg	4		6010B	Total/NA
Arsenic	110		3.7		mg/Kg	4		6010B	Total/NA
Chromium	590		1.9		mg/Kg	4		6010B	Total/NA
Cobalt	78		0.75		mg/Kg	4		6010B	Total/NA
Copper	6700		5.6		mg/Kg	4		6010B	Total/NA
Lead	4.6		1.9		mg/Kg	4		6010B	Total/NA
Nickel	1400		1.9		mg/Kg	4		6010B	Total/NA
Selenium	9.0		3.7		mg/Kg	4		6010B	Total/NA
Silver	7.5		0.93		mg/Kg	4		6010B	Total/NA
Vanadium	16		1.9		mg/Kg	4		6010B	Total/NA
Zinc	73		5.6		mg/Kg	4		6010B	Total/NA
Mercury	0.43		0.0090		mg/Kg	1		7471A	Total/NA

Analyte	Result	Qualifier	RL	RL	Unit	Dil Fac	D	Method	Prep Type
pH	6.88		0.100		SU	1		9045C	Soluble

Client Sample ID: MM-BKG — Lab Sample ID: 720-38393-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	6.7		1.9		mg/Kg	4		6010B	Total/NA
Arsenic	9.1		3.8		mg/Kg	4		6010B	Total/NA
Barium	39		1.9		mg/Kg	4		6010B	Total/NA
Chromium	1100		1.9		mg/Kg	4		6010B	Total/NA
Cobalt	240		0.77		mg/Kg	4		6010B	Total/NA
Copper	23		5.8		mg/Kg	4		6010B	Total/NA
Nickel	2800		1.9		mg/Kg	4		6010B	Total/NA
Thallium	2.0		1.9		mg/Kg	4		6010B	Total/NA
Vanadium	37		1.9		mg/Kg	4		6010B	Total/NA
Zinc	75		5.8		mg/Kg	4		6010B	Total/NA
Mercury	0.011		0.0098		mg/Kg	1		7471A	Total/NA

Analyte	Result	Qualifier	RL	RL	Unit	Dil Fac	D	Method	Prep Type
pH	6.95		0.100		SU	1		9045C	Soluble

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-SW-1

Date Collected: 10/27/11 08:43
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38393-1

Matrix: Water

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.010		mg/L		11/01/11 08:08	11/01/11 19:58	1
Arsenic	ND		0.010		mg/L		11/01/11 08:08	11/01/11 19:58	1
Barium	**0.064**		0.0050		mg/L		11/01/11 08:08	11/01/11 19:58	1
Beryllium	ND		0.0020		mg/L		11/01/11 08:08	11/01/11 19:58	1
Cadmium	ND		0.0025		mg/L		11/01/11 08:08	11/01/11 19:58	1
Calcium	**0.89**		0.20		mg/L		11/01/11 08:08	11/01/11 19:58	1
Chromium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 19:58	1
Cobalt	ND		0.0020		mg/L		11/01/11 08:08	11/01/11 19:58	1
Copper	ND		0.020		mg/L		11/01/11 08:08	11/01/11 19:58	1
Lead	ND		0.0050		mg/L		11/01/11 08:08	11/01/11 19:58	1
Molybdenum	ND		0.010		mg/L		11/01/11 08:08	11/01/11 19:58	1
Nickel	**0.020**		0.010		mg/L		11/01/11 08:08	11/01/11 19:58	1
Selenium	ND		0.020		mg/L		11/01/11 08:08	11/01/11 19:58	1
Magnesium	**28**		0.20		mg/L		11/01/11 08:08	11/01/11 19:58	1
Silver	ND		0.0050		mg/L		11/01/11 08:08	11/01/11 19:58	1
Thallium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 19:58	1
Vanadium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 19:58	1
Zinc	ND		0.020		mg/L		11/01/11 08:08	11/01/11 19:58	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/31/11 08:21	10/31/11 17:55	1

Method: SM 2340B - Hardness, Calculation

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness	**120**		1.9		mg/L			11/04/11 11:19	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
TOC Dup	ND		1.0		mg/L			11/02/11 13:18	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-SW-2

Date Collected: 10/27/11 10:35
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38393-2

Matrix: Water

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.010		mg/L		11/01/11 08:08	11/01/11 20:03	1
Arsenic	ND		0.010		mg/L		11/01/11 08:08	11/01/11 20:03	1
Barium	**0.063**		0.0050		mg/L		11/01/11 08:08	11/01/11 20:03	1
Beryllium	ND		0.0020		mg/L		11/01/11 08:08	11/01/11 20:03	1
Cadmium	ND		0.0025		mg/L		11/01/11 08:08	11/01/11 20:03	1
Calcium	**0.90**		0.20		mg/L		11/01/11 08:08	11/01/11 20:03	1
Chromium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 20:03	1
Cobalt	ND		0.0020		mg/L		11/01/11 08:08	11/01/11 20:03	1
Copper	ND		0.020		mg/L		11/01/11 08:08	11/01/11 20:03	1
Lead	ND		0.0050		mg/L		11/01/11 08:08	11/01/11 20:03	1
Molybdenum	ND		0.010		mg/L		11/01/11 08:08	11/01/11 20:03	1
Nickel	**0.020**		0.010		mg/L		11/01/11 08:08	11/01/11 20:03	1
Selenium	ND		0.020		mg/L		11/01/11 08:08	11/01/11 20:03	1
Magnesium	**29**		0.20		mg/L		11/01/11 08:08	11/01/11 20:03	1
Silver	ND		0.0050		mg/L		11/01/11 08:08	11/01/11 20:03	1
Thallium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 20:03	1
Vanadium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 20:03	1
Zinc	ND		0.020		mg/L		11/01/11 08:08	11/01/11 20:03	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/31/11 08:21	10/31/11 18:02	1

Method: SM 2340B - Hardness, Calculation

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness	**120**		1.9		mg/L			11/04/11 11:19	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
TOC Dup	ND		1.0		mg/L			11/02/11 13:58	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-SW-3

Date Collected: 10/27/11 12:20
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38393-3

Matrix: Water

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.010		mg/L		11/01/11 08:08	11/01/11 21:14	1
Arsenic	ND		0.010		mg/L		11/01/11 08:08	11/01/11 21:14	1
Barium	**0.039**		0.0050		mg/L		11/01/11 08:08	11/01/11 21:14	1
Beryllium	ND		0.0020		mg/L		11/01/11 08:08	11/01/11 21:14	1
Cadmium	ND		0.0025		mg/L		11/01/11 08:08	11/01/11 21:14	1
Calcium	**0.91**		0.20		mg/L		11/01/11 08:08	11/01/11 21:14	1
Chromium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 21:14	1
Cobalt	ND		0.0020		mg/L		11/01/11 08:08	11/01/11 21:14	1
Copper	ND		0.020		mg/L		11/01/11 08:08	11/01/11 21:14	1
Lead	ND		0.0050		mg/L		11/01/11 08:08	11/01/11 21:14	1
Molybdenum	ND		0.010		mg/L		11/01/11 08:08	11/01/11 21:14	1
Nickel	**0.019**		0.010		mg/L		11/01/11 08:08	11/01/11 21:14	1
Selenium	ND		0.020		mg/L		11/01/11 08:08	11/01/11 21:14	1
Magnesium	**28**		0.20		mg/L		11/01/11 08:08	11/01/11 21:14	1
Silver	ND		0.0050		mg/L		11/01/11 08:08	11/01/11 21:14	1
Thallium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 21:14	1
Vanadium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 21:14	1
Zinc	ND		0.020		mg/L		11/01/11 08:08	11/01/11 21:14	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/31/11 08:21	10/31/11 18:05	1

Method: SM 2340B - Hardness, Calculation

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness	**120**		1.9		mg/L			11/04/11 11:19	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
TOC Dup	ND		1.0		mg/L			11/02/11 14:16	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-SD-1

Date Collected: 10/27/11 08:43
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38393-4

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	11		1.8		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Arsenic	16		3.7		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Barium	20		1.8		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Beryllium	ND		0.37		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Cadmium	ND		0.46		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Chromium	1800		1.8		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Cobalt	260		0.73		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Copper	13		5.5		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Lead	2.0		1.8		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Molybdenum	ND		1.8		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Nickel	3000		1.8		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Selenium	ND		3.7		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Silver	ND		0.92		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Thallium	1.9		1.8		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Vanadium	53		1.8		mg/Kg		11/01/11 15:50	11/01/11 23:48	4
Zinc	61		5.5		mg/Kg		11/01/11 15:50	11/01/11 23:48	4

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.018		0.0088		mg/Kg		11/01/11 13:35	11/02/11 14:37	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.81		0.100		SU			10/31/11 14:28	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-SD-2

Date Collected: 10/27/11 10:35
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38393-5

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**8.7**		2.0		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Arsenic	**12**		3.9		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Barium	**9.7**		2.0		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Beryllium	ND		0.39		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Cadmium	ND		0.49		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Chromium	**1400**		2.0		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Cobalt	**130**		0.78		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Copper	**95**		5.9		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Lead	ND		2.0		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Molybdenum	ND		2.0		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Nickel	**2300**		2.0		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Selenium	ND		3.9		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Silver	ND		0.98		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Thallium	ND		2.0		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Vanadium	**42**		2.0		mg/Kg		11/01/11 15:50	11/01/11 23:52	4
Zinc	**46**		5.9		mg/Kg		11/01/11 15:50	11/01/11 23:52	4

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.018**		0.0097		mg/Kg		11/01/11 13:35	11/02/11 14:40	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.87**		0.100		SU			10/31/11 14:33	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-SD-3

Date Collected: 10/27/11 12:20
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38393-6

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**14**		1.9		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Arsenic	**21**		3.8		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Barium	**19**		1.9		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Beryllium	ND		0.38		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Cadmium	ND		0.48		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Chromium	**2400**		1.9		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Cobalt	**350**		0.76		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Copper	**120**		5.7		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Lead	**2.7**		1.9		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Molybdenum	ND		1.9		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Nickel	**4000**		1.9		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Selenium	ND		3.8		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Silver	ND		0.95		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Thallium	ND		1.9		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Vanadium	**65**		1.9		mg/Kg		11/01/11 15:50	11/01/11 23:56	4
Zinc	**73**		5.7		mg/Kg		11/01/11 15:50	11/01/11 23:56	4

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.014**		0.0097		mg/Kg		11/01/11 13:35	11/02/11 14:42	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**8.17**		0.100		SU			10/31/11 14:34	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-WP-1

Date Collected: 10/27/11 09:50
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38393-7

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**8.3**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Arsenic	**42**		3.8		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Barium	ND		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Beryllium	ND		0.38		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Cadmium	ND		0.48		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Chromium	**970**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Cobalt	**65**		0.77		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Copper	**32000**		140		mg/Kg		11/01/11 15:50	11/04/11 12:17	100
Lead	**35**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Molybdenum	ND		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Nickel	**610**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Selenium	**52**		3.8		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Silver	**8.4**		0.96		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Thallium	ND		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Vanadium	**23**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:09	4
Zinc	**86**		5.8		mg/Kg		11/01/11 15:50	11/02/11 00:09	4

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.34**		0.0095		mg/Kg		11/01/11 13:35	11/02/11 14:53	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**5.34**		0.100		SU			10/31/11 14:35	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-WP-2

Date Collected: 10/27/11 09:19
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38393-8

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	4.3		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Arsenic	45		3.8		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Barium	2.7		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Beryllium	ND		0.38		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Cadmium	ND		0.47		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Chromium	600		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Cobalt	86		0.75		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Copper	5200		5.7		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Lead	3.8		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Molybdenum	ND		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Nickel	1200		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Selenium	11		3.8		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Silver	2.4		0.94		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Thallium	ND		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Vanadium	12		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:13	4
Zinc	64		5.7		mg/Kg		11/01/11 15:50	11/02/11 00:13	4

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.26		0.0094		mg/Kg		11/01/11 13:35	11/02/11 14:55	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
pH	6.01		0.100		SU			10/31/11 14:37	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-WP-3

Date Collected: 10/27/11 14:00
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38393-9

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**4.1**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Arsenic	**110**		3.7		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Barium	ND		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Beryllium	ND		0.37		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Cadmium	ND		0.47		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Chromium	**590**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Cobalt	**78**		0.75		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Copper	**6700**		5.6		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Lead	**4.6**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Molybdenum	ND		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Nickel	**1400**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Selenium	**9.0**		3.7		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Silver	**7.5**		0.93		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Thallium	ND		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Vanadium	**16**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:18	4
Zinc	**73**		5.6		mg/Kg		11/01/11 15:50	11/02/11 00:18	4

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.43**		0.0090		mg/Kg		11/01/11 13:35	11/02/11 14:58	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.88**		0.100		SU			10/31/11 14:38	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-BKG

Date Collected: 10/27/11 14:15
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38393-10

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**6.7**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Arsenic	**9.1**		3.8		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Barium	**39**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Beryllium	ND		0.38		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Cadmium	ND		0.48		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Chromium	**1100**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Cobalt	**240**		0.77		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Copper	**23**		5.8		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Lead	ND		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Molybdenum	ND		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Nickel	**2800**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Selenium	ND		3.8		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Silver	ND		0.96		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Thallium	**2.0**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Vanadium	**37**		1.9		mg/Kg		11/01/11 15:50	11/02/11 00:31	4
Zinc	**75**		5.8		mg/Kg		11/01/11 15:50	11/02/11 00:31	4

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.011**		0.0098		mg/Kg		11/01/11 13:35	11/02/11 15:00	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.95**		0.100		SU			10/31/11 14:39	1

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 720-102037/1-A — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 102094 — **Prep Batch: 102037**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.010		mg/L		11/01/11 08:08	11/01/11 18:09	1
Arsenic	ND		0.010		mg/L		11/01/11 08:08	11/01/11 18:09	1
Barium	ND		0.0050		mg/L		11/01/11 08:08	11/01/11 18:09	1
Beryllium	ND		0.0020		mg/L		11/01/11 08:08	11/01/11 18:09	1
Cadmium	ND		0.0025		mg/L		11/01/11 08:08	11/01/11 18:09	1
Calcium	ND		0.20		mg/L		11/01/11 08:08	11/01/11 18:09	1
Chromium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 18:09	1
Cobalt	ND		0.0020		mg/L		11/01/11 08:08	11/01/11 18:09	1
Copper	ND		0.020		mg/L		11/01/11 08:08	11/01/11 18:09	1
Lead	ND		0.0050		mg/L		11/01/11 08:08	11/01/11 18:09	1
Molybdenum	ND		0.010		mg/L		11/01/11 08:08	11/01/11 18:09	1
Nickel	ND		0.010		mg/L		11/01/11 08:08	11/01/11 18:09	1
Selenium	ND		0.020		mg/L		11/01/11 08:08	11/01/11 18:09	1
Magnesium	ND		0.20		mg/L		11/01/11 08:08	11/01/11 18:09	1
Silver	ND		0.0050		mg/L		11/01/11 08:08	11/01/11 18:09	1
Thallium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 18:09	1
Vanadium	ND		0.010		mg/L		11/01/11 08:08	11/01/11 18:09	1
Zinc	ND		0.020		mg/L		11/01/11 08:08	11/01/11 18:09	1

Lab Sample ID: LCS 720-102037/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 102094 — **Prep Batch: 102037**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	1.00	1.01		mg/L		101	80 - 120
Arsenic	1.00	0.982		mg/L		98	80 - 120
Barium	1.00	1.02		mg/L		102	80 - 120
Beryllium	1.00	1.01		mg/L		101	80 - 120
Cadmium	1.00	0.964		mg/L		96	80 - 120
Calcium	10.0	10.4		mg/L		104	80 - 120
Chromium	1.00	0.999		mg/L		100	80 - 120
Cobalt	1.00	1.03		mg/L		103	80 - 120
Copper	1.00	0.992		mg/L		99	80 - 120
Lead	1.00	1.01		mg/L		101	80 - 120
Molybdenum	1.00	1.03		mg/L		103	80 - 120
Nickel	1.00	0.993		mg/L		99	80 - 120
Selenium	1.00	0.950		mg/L		95	80 - 120
Magnesium	10.0	10.2		mg/L		102	80 - 120
Silver	0.500	0.504		mg/L		101	80 - 120
Thallium	1.00	1.01		mg/L		101	80 - 120
Vanadium	1.00	1.02		mg/L		102	80 - 120
Zinc	1.00	1.01		mg/L		101	80 - 120

Lab Sample ID: LCSD 720-102037/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 102094 — **Prep Batch: 102037**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Antimony	1.00	0.988		mg/L		99	80 - 120	2	20
Arsenic	1.00	0.962		mg/L		96	80 - 120	2	20

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: LCSD 720-102037/3-A
Matrix: Water
Analysis Batch: 102094

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 102037

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Barium	1.00	1.00		mg/L		100	80 - 120	2	20
Beryllium	1.00	0.980		mg/L		98	80 - 120	3	20
Cadmium	1.00	0.937		mg/L		94	80 - 120	3	20
Calcium	10.0	10.1		mg/L		101	80 - 120	2	20
Chromium	1.00	0.960		mg/L		96	80 - 120	4	20
Cobalt	1.00	1.01		mg/L		101	80 - 120	2	20
Copper	1.00	0.967		mg/L		97	80 - 120	3	20
Lead	1.00	0.992		mg/L		99	80 - 120	2	20
Molybdenum	1.00	1.02		mg/L		102	80 - 120	2	20
Nickel	1.00	0.973		mg/L		97	80 - 120	2	20
Selenium	1.00	0.927		mg/L		93	80 - 120	2	20
Magnesium	10.0	10.0		mg/L		100	80 - 120	2	20
Silver	0.500	0.497		mg/L		99	80 - 120	1	20
Thallium	1.00	0.990		mg/L		99	80 - 120	2	20
Vanadium	1.00	0.987		mg/L		99	80 - 120	3	20
Zinc	1.00	0.985		mg/L		98	80 - 120	2	20

Lab Sample ID: MB 720-102081/1-A
Matrix: Solid
Analysis Batch: 102122

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 102081

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.50		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Arsenic	ND		1.0		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Barium	ND		0.50		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Beryllium	ND		0.10		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Cadmium	ND		0.13		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Cobalt	ND		0.20		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Lead	ND		0.50		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Molybdenum	ND		0.50		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Nickel	ND		0.50		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Selenium	ND		1.0		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Silver	ND		0.25		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Thallium	ND		0.50		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Vanadium	ND		0.50		mg/Kg		11/01/11 15:50	11/01/11 22:49	1
Zinc	ND		1.5		mg/Kg		11/01/11 15:50	11/01/11 22:49	1

Lab Sample ID: MB 720-102081/1-A
Matrix: Solid
Analysis Batch: 102150

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 102081

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chromium	ND		0.50		mg/Kg		11/01/11 15:50	11/02/11 11:38	1
Copper	ND		1.5		mg/Kg		11/01/11 15:50	11/02/11 11:38	1

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: LCS 720-102081/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102122 — **Prep Batch: 102081**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	50.0	46.6		mg/Kg		93	80 - 120
Arsenic	50.0	47.6		mg/Kg		95	80 - 120
Barium	50.0	49.0		mg/Kg		98	80 - 120
Beryllium	50.0	49.9		mg/Kg		100	80 - 120
Cadmium	50.0	49.4		mg/Kg		99	80 - 120
Chromium	50.0	50.6		mg/Kg		101	80 - 120
Cobalt	50.0	49.4		mg/Kg		99	80 - 120
Copper	50.0	55.9		mg/Kg		112	80 - 120
Lead	50.0	50.0		mg/Kg		100	80 - 120
Molybdenum	50.0	50.2		mg/Kg		100	80 - 120
Nickel	50.0	50.2		mg/Kg		100	80 - 120
Selenium	50.0	47.4		mg/Kg		95	80 - 120
Silver	25.0	23.9		mg/Kg		96	80 - 120
Thallium	50.0	50.1		mg/Kg		100	80 - 120
Vanadium	50.0	50.4		mg/Kg		101	80 - 120
Zinc	50.0	47.6		mg/Kg		95	80 - 120

Lab Sample ID: LCSD 720-102081/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102122 — **Prep Batch: 102081**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Antimony	50.0	46.5		mg/Kg		93	80 - 120	0	20
Arsenic	50.0	47.3		mg/Kg		95	80 - 120	1	20
Barium	50.0	48.3		mg/Kg		97	80 - 120	1	20
Beryllium	50.0	49.4		mg/Kg		99	80 - 120	1	20
Cadmium	50.0	49.6		mg/Kg		99	80 - 120	1	20
Chromium	50.0	50.2		mg/Kg		100	80 - 120	1	20
Cobalt	50.0	48.9		mg/Kg		98	80 - 120	1	20
Copper	50.0	58.5		mg/Kg		117	80 - 120	5	20
Lead	50.0	50.0		mg/Kg		100	80 - 120	0	20
Molybdenum	50.0	50.0		mg/Kg		100	80 - 120	0	20
Nickel	50.0	50.4		mg/Kg		101	80 - 120	0	20
Selenium	50.0	47.3		mg/Kg		95	80 - 120	0	20
Silver	25.0	23.4		mg/Kg		94	80 - 120	2	20
Thallium	50.0	50.1		mg/Kg		100	80 - 120	0	20
Vanadium	50.0	50.2		mg/Kg		100	80 - 120	0	20
Zinc	50.0	47.3		mg/Kg		95	80 - 120	1	20

Lab Sample ID: LCSSRM 720-102081/23-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102122 — **Prep Batch: 102081**

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	105	72.3		mg/Kg		69	11 - 101
Arsenic	79.4	74.6		mg/Kg		94	69 - 119
Barium	391	351		mg/Kg		90	61 - 117
Beryllium	304	284		mg/Kg		93	56 - 102
Cadmium	48.3	44.0		mg/Kg		91	67 - 118
Chromium	171	163		mg/Kg		96	67 - 121

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: LCSSRM 720-102081/23-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102122 — **Prep Batch: 102081**

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec. Limits
Cobalt	59.2	54.6		mg/Kg		92	64 - 133
Copper	327	314		mg/Kg		96	68 - 126
Lead	181	163		mg/Kg		90	62 - 113
Molybdenum	156	153		mg/Kg		98	62 - 128
Nickel	76.0	69.6		mg/Kg		92	65 - 117
Selenium	76.9	68.2		mg/Kg		89	63 - 126
Silver	29.1	26.7		mg/Kg		92	51 - 130
Thallium	192	173		mg/Kg		90	64 - 124
Vanadium	213	211		mg/Kg		99	67 - 123
Zinc	256	243		mg/Kg		95	62 - 110

Lab Sample ID: 720-38393-7 MS — **Client Sample ID: MM-WP-1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102122 — **Prep Batch: 102081**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	8.3		46.7	18.5	F	mg/Kg		22	75 - 125
Arsenic	42		46.7	99.3		mg/Kg		123	75 - 125
Barium	ND		46.7	45.3		mg/Kg		95	75 - 125
Beryllium	ND		46.7	42.8		mg/Kg		92	75 - 125
Cadmium	ND		46.7	45.1		mg/Kg		96	75 - 125
Chromium	970		46.7	1270	4	mg/Kg		637	75 - 125
Cobalt	65		46.7	109		mg/Kg		95	75 - 125
Lead	35		46.7	68.4	F	mg/Kg		72	75 - 125
Molybdenum	ND		46.7	43.2		mg/Kg		92	75 - 125
Nickel	610		46.7	666	4	mg/Kg		127	75 - 125
Selenium	52		46.7	87.7		mg/Kg		76	75 - 125
Silver	8.4		23.4	28.6		mg/Kg		87	75 - 125
Thallium	ND		46.7	44.3		mg/Kg		91	75 - 125
Vanadium	23		46.7	70.2		mg/Kg		101	75 - 125
Zinc	86		46.7	135		mg/Kg		106	75 - 125

Lab Sample ID: 720-38393-7 MS — **Client Sample ID: MM-WP-1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102333 — **Prep Batch: 102081**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Copper	32000		46.7	28100	4	mg/Kg		-8946	75 - 125

Lab Sample ID: 720-38393-7 MSD — **Client Sample ID: MM-WP-1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102122 — **Prep Batch: 102081**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Antimony	8.3		45.9	18.7	F	mg/Kg		23	75 - 125	1	20
Arsenic	42		45.9	89.9		mg/Kg		105	75 - 125	10	20
Barium	ND		45.9	45.1		mg/Kg		96	75 - 125	0	20
Beryllium	ND		45.9	43.0		mg/Kg		94	75 - 125	1	20
Cadmium	ND		45.9	45.3		mg/Kg		98	75 - 125	0	20
Chromium	970		45.9	1020	4 F	mg/Kg		94	75 - 125	22	20

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: 720-38393-7 MSD — **Client Sample ID: MM-WP-1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102122 — **Prep Batch: 102081**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cobalt	65		45.9	96.9	F	mg/Kg		71	75 - 125	12	20
Lead	35		45.9	60.7	F	mg/Kg		56	75 - 125	12	20
Molybdenum	ND		45.9	44.2		mg/Kg		96	75 - 125	2	20
Nickel	610		45.9	651	4	mg/Kg		97	75 - 125	2	20
Selenium	52		45.9	85.7	F	mg/Kg		73	75 - 125	2	20
Silver	8.4		22.9	26.9		mg/Kg		81	75 - 125	6	20
Thallium	ND		45.9	44.7		mg/Kg		94	75 - 125	1	20
Vanadium	23		45.9	66.9		mg/Kg		96	75 - 125	5	20
Zinc	86		45.9	109	F	mg/Kg		51	75 - 125	21	20

Lab Sample ID: 720-38393-7 MSD — **Client Sample ID: MM-WP-1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102333 — **Prep Batch: 102081**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Copper	32000		45.9	18000	4 F	mg/Kg		-3110 8	75 - 125	44	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 720-101969/1-A — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 102016 — **Prep Batch: 101969**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.00020		mg/L		10/31/11 08:21	10/31/11 17:35	1

Lab Sample ID: LCS 720-101969/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 102016 — **Prep Batch: 101969**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.0100	0.00944		mg/L		94	85 - 115

Lab Sample ID: LCSD 720-101969/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 102016 — **Prep Batch: 101969**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.0100	0.00938		mg/L		94	85 - 115	1	20

Lab Sample ID: 720-38393-1 MS — **Client Sample ID: MM-SW-1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 102016 — **Prep Batch: 101969**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	ND		0.0100	0.00912		mg/L		91	70 - 130

Method: 7470A - Mercury (CVAA) (Continued)

Lab Sample ID: 720-38393-1 MSD — **Client Sample ID: MM-SW-1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 102016 — **Prep Batch: 101969**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	ND		0.0100	0.00932		mg/L		93	70 - 130	2	20

Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 720-102065/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102166 — **Prep Batch: 102065**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.010		mg/Kg		11/01/11 13:35	11/02/11 14:27	1

Lab Sample ID: LCS 720-102065/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102166 — **Prep Batch: 102065**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.833	0.740		mg/Kg		89	80 - 120

Lab Sample ID: LCSD 720-102065/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102166 — **Prep Batch: 102065**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.833	0.728		mg/Kg		87	80 - 120	2	20

Lab Sample ID: 720-38393-7 MS — **Client Sample ID: MM-WP-1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102166 — **Prep Batch: 102065**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.34		0.735	0.801	F	mg/Kg		63	75 - 125

Lab Sample ID: 720-38393-7 MSD — **Client Sample ID: MM-WP-1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 102166 — **Prep Batch: 102065**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.34		0.820	0.836	F	mg/Kg		61	75 - 125	4	20

Method: SM 2340B - Hardness, Calculation

Lab Sample ID: MB 720-102321/1 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 102321

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness	ND		1.9		mg/L			11/04/11 11:19	1

QC Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Method: 9045C - pH

Lab Sample ID: LCS 720-101976/1-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Soluble**
Analysis Batch: 101979

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
pH			7.00	7.040		SU		101	99 - 101		

Lab Sample ID: 720-38393-4 DU — **Client Sample ID: MM-SD-1**
Matrix: Solid — **Prep Type: Soluble**
Analysis Batch: 101979

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	7.81			7.910		SU				1	20

Method: SM 5310C - TOC

Lab Sample ID: MB 500-131251/3 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 131251

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
TOC Dup	ND		1.0		mg/L			11/02/11 08:47	1

Lab Sample ID: LCS 500-131251/4 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 131251

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
TOC Result 1			10.0	8.31		mg/L		83	80 - 120		
TOC Result 2			10.0	8.14		mg/L		81	80 - 120		
TOC Dup			10.0	8.23		mg/L		82	80 - 120		

Lab Sample ID: 720-38393-1 MS — **Client Sample ID: MM-SW-1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 131251

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
TOC Result 1	ND		10.0	9.12		mg/L		86	75 - 125		
TOC Result 2	ND		10.0	9.12		mg/L		86	75 - 125		
TOC Dup	ND		10.0	9.12		mg/L		86	75 - 125		

Lab Sample ID: 720-38393-1 MSD — **Client Sample ID: MM-SW-1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 131251

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
TOC Result 1	ND		10.0	9.19		mg/L		87	75 - 125	1	20
TOC Result 2	ND		10.0	9.19		mg/L		87	75 - 125	1	20
TOC Dup	ND		10.0	9.19		mg/L		87	75 - 125	1	20

QC Association Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Metals

Prep Batch: 101969

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-1	MM-SW-1	Total/NA	Water	7470A	
720-38393-1 MS	MM-SW-1	Total/NA	Water	7470A	
720-38393-1 MSD	MM-SW-1	Total/NA	Water	7470A	
720-38393-2	MM-SW-2	Total/NA	Water	7470A	
720-38393-3	MM-SW-3	Total/NA	Water	7470A	
LCS 720-101969/2-A	Lab Control Sample	Total/NA	Water	7470A	
LCSD 720-101969/3-A	Lab Control Sample Dup	Total/NA	Water	7470A	
MB 720-101969/1-A	Method Blank	Total/NA	Water	7470A	

Analysis Batch: 102016

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-1	MM-SW-1	Total/NA	Water	7470A	101969
720-38393-1 MS	MM-SW-1	Total/NA	Water	7470A	101969
720-38393-1 MSD	MM-SW-1	Total/NA	Water	7470A	101969
720-38393-2	MM-SW-2	Total/NA	Water	7470A	101969
720-38393-3	MM-SW-3	Total/NA	Water	7470A	101969
LCS 720-101969/2-A	Lab Control Sample	Total/NA	Water	7470A	101969
LCSD 720-101969/3-A	Lab Control Sample Dup	Total/NA	Water	7470A	101969
MB 720-101969/1-A	Method Blank	Total/NA	Water	7470A	101969

Prep Batch: 102037

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-1	MM-SW-1	Total/NA	Water	3010A	
720-38393-2	MM-SW-2	Total/NA	Water	3010A	
720-38393-3	MM-SW-3	Total/NA	Water	3010A	
LCS 720-102037/2-A	Lab Control Sample	Total/NA	Water	3010A	
LCSD 720-102037/3-A	Lab Control Sample Dup	Total/NA	Water	3010A	
MB 720-102037/1-A	Method Blank	Total/NA	Water	3010A	

Prep Batch: 102065

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-4	MM-SD-1	Total/NA	Solid	7471A	
720-38393-5	MM-SD-2	Total/NA	Solid	7471A	
720-38393-6	MM-SD-3	Total/NA	Solid	7471A	
720-38393-7	MM-WP-1	Total/NA	Solid	7471A	
720-38393-7 MS	MM-WP-1	Total/NA	Solid	7471A	
720-38393-7 MSD	MM-WP-1	Total/NA	Solid	7471A	
720-38393-8	MM-WP-2	Total/NA	Solid	7471A	
720-38393-9	MM-WP-3	Total/NA	Solid	7471A	
720-38393-10	MM-BKG	Total/NA	Solid	7471A	
LCS 720-102065/2-A	Lab Control Sample	Total/NA	Solid	7471A	
LCSD 720-102065/3-A	Lab Control Sample Dup	Total/NA	Solid	7471A	
MB 720-102065/1-A	Method Blank	Total/NA	Solid	7471A	

Prep Batch: 102081

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-4	MM-SD-1	Total/NA	Solid	3050B	
720-38393-5	MM-SD-2	Total/NA	Solid	3050B	
720-38393-6	MM-SD-3	Total/NA	Solid	3050B	
720-38393-7	MM-WP-1	Total/NA	Solid	3050B	
720-38393-7 MS	MM-WP-1	Total/NA	Solid	3050B	
720-38393-7 MSD	MM-WP-1	Total/NA	Solid	3050B	

Metals (Continued)

Prep Batch: 102081 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-8	MM-WP-2	Total/NA	Solid	3050B	
720-38393-9	MM-WP-3	Total/NA	Solid	3050B	
720-38393-10	MM-BKG	Total/NA	Solid	3050B	
LCS 720-102081/2-A	Lab Control Sample	Total/NA	Solid	3050B	
LCSD 720-102081/3-A	Lab Control Sample Dup	Total/NA	Solid	3050B	
LCSSRM 720-102081/23-A	Lab Control Sample	Total/NA	Solid	3050B	
MB 720-102081/1-A	Method Blank	Total/NA	Solid	3050B	

Analysis Batch: 102094

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 720-102037/2-A	Lab Control Sample	Total/NA	Water	6010B	102037
LCSD 720-102037/3-A	Lab Control Sample Dup	Total/NA	Water	6010B	102037
MB 720-102037/1-A	Method Blank	Total/NA	Water	6010B	102037

Analysis Batch: 102102

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-1	MM-SW-1	Total/NA	Water	6010B	102037
720-38393-2	MM-SW-2	Total/NA	Water	6010B	102037

Analysis Batch: 102108

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-3	MM-SW-3	Total/NA	Water	6010B	102037

Analysis Batch: 102122

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-4	MM-SD-1	Total/NA	Solid	6010B	102081
720-38393-5	MM-SD-2	Total/NA	Solid	6010B	102081
720-38393-6	MM-SD-3	Total/NA	Solid	6010B	102081
720-38393-7	MM-WP-1	Total/NA	Solid	6010B	102081
720-38393-7 MS	MM-WP-1	Total/NA	Solid	6010B	102081
720-38393-7 MSD	MM-WP-1	Total/NA	Solid	6010B	102081
720-38393-8	MM-WP-2	Total/NA	Solid	6010B	102081
720-38393-9	MM-WP-3	Total/NA	Solid	6010B	102081
720-38393-10	MM-BKG	Total/NA	Solid	6010B	102081
LCS 720-102081/2-A	Lab Control Sample	Total/NA	Solid	6010B	102081
LCSD 720-102081/3-A	Lab Control Sample Dup	Total/NA	Solid	6010B	102081
LCSSRM 720-102081/23-A	Lab Control Sample	Total/NA	Solid	6010B	102081
MB 720-102081/1-A	Method Blank	Total/NA	Solid	6010B	102081

Analysis Batch: 102150

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 720-102081/1-A	Method Blank	Total/NA	Solid	6010B	102081

Analysis Batch: 102166

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-4	MM-SD-1	Total/NA	Solid	7471A	102065
720-38393-5	MM-SD-2	Total/NA	Solid	7471A	102065
720-38393-6	MM-SD-3	Total/NA	Solid	7471A	102065
720-38393-7	MM-WP-1	Total/NA	Solid	7471A	102065
720-38393-7 MS	MM-WP-1	Total/NA	Solid	7471A	102065
720-38393-7 MSD	MM-WP-1	Total/NA	Solid	7471A	102065
720-38393-8	MM-WP-2	Total/NA	Solid	7471A	102065

Metals (Continued)

Analysis Batch: 102166 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-9	MM-WP-3	Total/NA	Solid	7471A	102065
720-38393-10	MM-BKG	Total/NA	Solid	7471A	102065
LCS 720-102065/2-A	Lab Control Sample	Total/NA	Solid	7471A	102065
LCSD 720-102065/3-A	Lab Control Sample Dup	Total/NA	Solid	7471A	102065
MB 720-102065/1-A	Method Blank	Total/NA	Solid	7471A	102065

Analysis Batch: 102321

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-1	MM-SW-1	Total/NA	Water	SM 2340B	
720-38393-2	MM-SW-2	Total/NA	Water	SM 2340B	
720-38393-3	MM-SW-3	Total/NA	Water	SM 2340B	
LCS 720-102321/2	Lab Control Sample	Total/NA	Water	SM 2340B	
LCSD 720-102321/3	Lab Control Sample Dup	Total/NA	Water	SM 2340B	
MB 720-102321/1	Method Blank	Total/NA	Water	SM 2340B	

Analysis Batch: 102333

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-7	MM-WP-1	Total/NA	Solid	6010B	102081
720-38393-7 MS	MM-WP-1	Total/NA	Solid	6010B	102081
720-38393-7 MSD	MM-WP-1	Total/NA	Solid	6010B	102081

General Chemistry

Leach Batch: 101976

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-4	MM-SD-1	Soluble	Solid	DI Leach	
720-38393-4 DU	MM-SD-1	Soluble	Solid	DI Leach	
720-38393-5	MM-SD-2	Soluble	Solid	DI Leach	
720-38393-6	MM-SD-3	Soluble	Solid	DI Leach	
720-38393-7	MM-WP-1	Soluble	Solid	DI Leach	
720-38393-8	MM-WP-2	Soluble	Solid	DI Leach	
720-38393-9	MM-WP-3	Soluble	Solid	DI Leach	
720-38393-10	MM-BKG	Soluble	Solid	DI Leach	
LCS 720-101976/1-A	Lab Control Sample	Soluble	Solid	DI Leach	

Analysis Batch: 101979

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-4	MM-SD-1	Soluble	Solid	9045C	
720-38393-4 DU	MM-SD-1	Soluble	Solid	9045C	
720-38393-5	MM-SD-2	Soluble	Solid	9045C	
720-38393-6	MM-SD-3	Soluble	Solid	9045C	
720-38393-7	MM-WP-1	Soluble	Solid	9045C	
720-38393-8	MM-WP-2	Soluble	Solid	9045C	
720-38393-9	MM-WP-3	Soluble	Solid	9045C	
720-38393-10	MM-BKG	Soluble	Solid	9045C	
LCS 720-101976/1-A	Lab Control Sample	Soluble	Solid	9045C	

Analysis Batch: 131251

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-1	MM-SW-1	Total/NA	Water	SM 5310C	
720-38393-1 MS	MM-SW-1	Total/NA	Water	SM 5310C	
720-38393-1 MSD	MM-SW-1	Total/NA	Water	SM 5310C	

General Chemistry (Continued)

Analysis Batch: 131251 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-2	MM-SW-2	Total/NA	Water	SM 5310C	
720-38393-3	MM-SW-3	Total/NA	Water	SM 5310C	
LCS 500-131251/4	Lab Control Sample	Total/NA	Water	SM 5310C	
MB 500-131251/3	Method Blank	Total/NA	Water	SM 5310C	

Lab Chronicle

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-SW-1 — Lab Sample ID: 720-38393-1

Date Collected: 10/27/11 08:43 — **Matrix: Water**
Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	7470A			101969	10/31/11 08:21	ET	TAL SF
Total/NA	Analysis	7470A		1	102016	10/31/11 17:55	SK	TAL SF
Total/NA	Prep	3010A			102037	11/01/11 08:08	ET	TAL SF
Total/NA	Analysis	6010B		1	102102	11/01/11 19:58	BA	TAL SF
Total/NA	Analysis	SM 2340B		1	102321	11/04/11 11:19	CAM	TAL SF
Total/NA	Analysis	SM 5310C		1	131251	11/02/11 13:18	KD	TAL CHI

Client Sample ID: MM-SW-2 — Lab Sample ID: 720-38393-2

Date Collected: 10/27/11 10:35 — **Matrix: Water**
Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	7470A			101969	10/31/11 08:21	ET	TAL SF
Total/NA	Analysis	7470A		1	102016	10/31/11 18:02	SK	TAL SF
Total/NA	Prep	3010A			102037	11/01/11 08:08	ET	TAL SF
Total/NA	Analysis	6010B		1	102102	11/01/11 20:03	BA	TAL SF
Total/NA	Analysis	SM 2340B		1	102321	11/04/11 11:19	CAM	TAL SF
Total/NA	Analysis	SM 5310C		1	131251	11/02/11 13:58	KD	TAL CHI

Client Sample ID: MM-SW-3 — Lab Sample ID: 720-38393-3

Date Collected: 10/27/11 12:20 — **Matrix: Water**
Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	7470A			101969	10/31/11 08:21	ET	TAL SF
Total/NA	Analysis	7470A		1	102016	10/31/11 18:05	SK	TAL SF
Total/NA	Prep	3010A			102037	11/01/11 08:08	ET	TAL SF
Total/NA	Analysis	6010B		1	102108	11/01/11 21:14	BA	TAL SF
Total/NA	Analysis	SM 2340B		1	102321	11/04/11 11:19	CAM	TAL SF
Total/NA	Analysis	SM 5310C		1	131251	11/02/11 14:16	KD	TAL CHI

Client Sample ID: MM-SD-1 — Lab Sample ID: 720-38393-4

Date Collected: 10/27/11 08:43 — **Matrix: Solid**
Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			102081	11/01/11 15:50	ET	TAL SF
Total/NA	Analysis	6010B		4	102122	11/01/11 23:48	BA	TAL SF
Total/NA	Prep	7471A			102065	11/01/11 13:35	ET	TAL SF
Total/NA	Analysis	7471A		1	102166	11/02/11 14:37	EFH	TAL SF
Soluble	Leach	DI Leach			101976	10/31/11 09:17	DAF	TAL SF
Soluble	Analysis	9045C		1	101979	10/31/11 14:28	DAF	TAL SF

Lab Chronicle

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-SD-2

Lab Sample ID: 720-38393-5

Date Collected: 10/27/11 10:35
Matrix: Solid
Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			102081	11/01/11 15:50	ET	TAL SF
Total/NA	Analysis	6010B		4	102122	11/01/11 23:52	BA	TAL SF
Total/NA	Prep	7471A			102065	11/01/11 13:35	ET	TAL SF
Total/NA	Analysis	7471A		1	102166	11/02/11 14:40	EFH	TAL SF
Soluble	Leach	DI Leach			101976	10/31/11 09:17	DAF	TAL SF
Soluble	Analysis	9045C		1	101979	10/31/11 14:33	DAF	TAL SF

Client Sample ID: MM-SD-3

Lab Sample ID: 720-38393-6

Date Collected: 10/27/11 12:20
Matrix: Solid
Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			102081	11/01/11 15:50	ET	TAL SF
Total/NA	Analysis	6010B		4	102122	11/01/11 23:56	BA	TAL SF
Total/NA	Prep	7471A			102065	11/01/11 13:35	ET	TAL SF
Total/NA	Analysis	7471A		1	102166	11/02/11 14:42	EFH	TAL SF
Soluble	Leach	DI Leach			101976	10/31/11 09:17	DAF	TAL SF
Soluble	Analysis	9045C		1	101979	10/31/11 14:34	DAF	TAL SF

Client Sample ID: MM-WP-1

Lab Sample ID: 720-38393-7

Date Collected: 10/27/11 09:50
Matrix: Solid
Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			102081	11/01/11 15:50	ET	TAL SF
Total/NA	Analysis	6010B		4	102122	11/02/11 00:09	BA	TAL SF
Total/NA	Prep	7471A			102065	11/01/11 13:35	ET	TAL SF
Total/NA	Analysis	7471A		1	102166	11/02/11 14:53	EFH	TAL SF
Total/NA	Analysis	6010B		100	102333	11/04/11 12:17	CAM	TAL SF
Soluble	Leach	DI Leach			101976	10/31/11 09:17	DAF	TAL SF
Soluble	Analysis	9045C		1	101979	10/31/11 14:35	DAF	TAL SF

Client Sample ID: MM-WP-2

Lab Sample ID: 720-38393-8

Date Collected: 10/27/11 09:19
Matrix: Solid
Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			102081	11/01/11 15:50	ET	TAL SF
Total/NA	Analysis	6010B		4	102122	11/02/11 00:13	BA	TAL SF
Total/NA	Prep	7471A			102065	11/01/11 13:35	ET	TAL SF
Total/NA	Analysis	7471A		1	102166	11/02/11 14:55	EFH	TAL SF
Soluble	Leach	DI Leach			101976	10/31/11 09:17	DAF	TAL SF
Soluble	Analysis	9045C		1	101979	10/31/11 14:37	DAF	TAL SF

Lab Chronicle

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Client Sample ID: MM-WP-3

Lab Sample ID: 720-38393-9

Date Collected: 10/27/11 14:00
Matrix: Solid
Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			102081	11/01/11 15:50	ET	TAL SF
Total/NA	Analysis	6010B		4	102122	11/02/11 00:18	BA	TAL SF
Total/NA	Prep	7471A			102065	11/01/11 13:35	ET	TAL SF
Total/NA	Analysis	7471A		1	102166	11/02/11 14:58	EFH	TAL SF
Soluble	Leach	DI Leach			101976	10/31/11 09:17	DAF	TAL SF
Soluble	Analysis	9045C		1	101979	10/31/11 14:38	DAF	TAL SF

Client Sample ID: MM-BKG

Lab Sample ID: 720-38393-10

Date Collected: 10/27/11 14:15
Matrix: Solid
Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			102081	11/01/11 15:50	ET	TAL SF
Total/NA	Analysis	6010B		4	102122	11/02/11 00:31	BA	TAL SF
Total/NA	Prep	7471A			102065	11/01/11 13:35	ET	TAL SF
Total/NA	Analysis	7471A		1	102166	11/02/11 15:00	EFH	TAL SF
Soluble	Leach	DI Leach			101976	10/31/11 09:17	DAF	TAL SF
Soluble	Analysis	9045C		1	101979	10/31/11 14:39	DAF	TAL SF

Laboratory References:

TAL CHI = TestAmerica Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

TAL SF = TestAmerica San Francisco, 1220 Quarry Lane, Pleasanton, CA 94566, TEL (925)484-1919

Certification Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica San Francisco	California	State Program	9	2496
TestAmerica Chicago	ACLASS	DoD ELAP		ADE-1429
TestAmerica Chicago	ACLASS	ISO/IEC 17025		AT-1428
TestAmerica Chicago	Alabama	State Program	4	40461
TestAmerica Chicago	California	NELAC	9	01132CA
TestAmerica Chicago	Florida	NELAC	4	E871072
TestAmerica Chicago	Georgia	Georgia EPD	4	N/A
TestAmerica Chicago	Georgia	State Program	4	939
TestAmerica Chicago	Hawaii	State Program	9	N/A
TestAmerica Chicago	Illinois	NELAC	5	100201
TestAmerica Chicago	Indiana	State Program	5	C-IL-02
TestAmerica Chicago	Iowa	State Program	7	82
TestAmerica Chicago	Kansas	NELAC	7	E-10161
TestAmerica Chicago	Kentucky	Kentucky UST	4	66
TestAmerica Chicago	Kentucky	State Program	4	90023
TestAmerica Chicago	Louisiana	NELAC	6	30720
TestAmerica Chicago	Massachusetts	State Program	1	M-IL035
TestAmerica Chicago	Mississippi	State Program	4	N/A
TestAmerica Chicago	North Carolina	North Carolina DENR	4	291
TestAmerica Chicago	Oklahoma	State Program	6	8908
TestAmerica Chicago	South Carolina	State Program	4	77001
TestAmerica Chicago	Texas	NELAC	6	T104704252-09-TX
TestAmerica Chicago	USDA	USDA		P330-09-00027
TestAmerica Chicago	Virginia	NELAC Secondary AB	3	460142
TestAmerica Chicago	Wisconsin	State Program	5	999580010
TestAmerica Chicago	Wyoming	State Program	8	8TMS-Q

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

Method Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL SF
7470A	Mercury (CVAA)	SW846	TAL SF
7471A	Mercury (CVAA)	SW846	TAL SF
SM 2340B	Hardness, Calculation	SM	TAL SF
9045C	pH	SW846	TAL SF
SM 5310C	TOC	SM	TAL CHI

Protocol References:

SM = "Standard Methods For The Examination Of Water And Wastewater",

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CHI = TestAmerica Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

TAL SF = TestAmerica San Francisco, 1220 Quarry Lane, Pleasanton, CA 94566, TEL (925)484-1919

Sample Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
720-38393-1	MM-SW-1	Water	10/27/11 08:43	10/28/11 19:15
720-38393-2	MM-SW-2	Water	10/27/11 10:35	10/28/11 19:15
720-38393-3	MM-SW-3	Water	10/27/11 12:20	10/28/11 19:15
720-38393-4	MM-SD-1	Solid	10/27/11 08:43	10/28/11 19:15
720-38393-5	MM-SD-2	Solid	10/27/11 10:35	10/28/11 19:15
720-38393-6	MM-SD-3	Solid	10/27/11 12:20	10/28/11 19:15
720-38393-7	MM-WP-1	Solid	10/27/11 09:50	10/28/11 19:15
720-38393-8	MM-WP-2	Solid	10/27/11 09:19	10/28/11 19:15
720-38393-9	MM-WP-3	Solid	10/27/11 14:00	10/28/11 19:15
720-38393-10	MM-BKG	Solid	10/27/11 14:15	10/28/11 19:15

134602

ERRG

Engineering / Remediation Resources Group, Inc.
115 Sasome St Suite 200
San Francisco CA, 94104
Phone: (925) 969-0750
Fax: (925) 969-0751

720-38393 Lab No.

Page 1 of 1

Chain-of-Custody Record and Analysis Request

Project Contact (Hardcopy or PDF To): Samantha.Knight@erg.com	California EDF Report? ☐ Yes ☐ No
Laboratory / Address: Test America Inc	Electronic Deliverables To (Email Address):
Phone No.: / Fax No.:	Sampler: SCK / TA
Project Number: 2011-145 / Phase # / Task # 01.02	
Project Name: Mammoth Mine	Project Address:
Project Manager:	

Sample Designation	Sampling Date	Sampling Time	Container: 8oz Jar	Container: 1 Poly	Container: 3 VOA	Matrix: Soil/Sed	Matrix: Aq	Analysis: Cam 17 metals 6020B	Analysis: Rcra pH 9045	Analysis: Hardness 2007/6010	Analysis: TOC 5310	12 hr/ 24 hr/ 48 hr/ 72 hr/STD (1 wk) TAT	Number of Containers	Comments	For Lab Use Only
MM-SW-1	10/27/11	0843		1	3		X	X		X	X	STD	4		
MM-SW-2	10/27/11	1035		1	3		X	X		X	X	STD	4		
MM-SW-3	10/27/11	1220		1	3		X	X		X	X	STD	4		
MM-SD-1	10/27/11	0843	1			X		X	X			STD	1		
MM-SD-2	10/27/11	1035	1			X		X	X			STD	1		
MM-SD-3	10/27/11	1220	1			X		X	X			STD	1		
MM-WP-1	10/27/11	0950	1			X		X	X			STD	1		
MM-WP-2	10/27/11	0919	1			X		X	X			STD	1		
MM-WP-3	10/27/11	1400	1			X		X	X			STD	1		
MM-BKG	10/27/11	1415	1			X		X	X			STD	1		

Relinquished by:	Date	Time	Received by:
[signature]	10/28/11	1430	[signature]
[signature]	10/28/11	1915	
Relinquished by:	Date	Time	Received by Laboratory:
	10/28/11	1915	Joan Mullen

Remarks: 2.5°C
Homogenize Samples for Soil Before analysis

4.5°C

11/4/2011

Login Sample Receipt Checklist

Client: Engineering Remediation Resources Group.

Job Number: 720-38393-1

Login Number: 38393

List Source: TestAmerica San Francisco

List Number: 1

Creator: Mullen, Joan

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	True	

Login Sample Receipt Checklist

Client: Engineering Remediation Resources Group.

Job Number: 720-38393-1

Login Number: 38393
List Number: 1
Creator: Kelsey, Shawn M

List Source: TestAmerica Chicago
List Creation: 11/01/11 11:33 AM

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	True	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica San Francisco
1220 Quarry Lane
Pleasanton, CA 94566
Tel: (925)484-1919

TestAmerica Job ID: 720-38394-1
Client Project/Site: Mammoth Mine

For:
Engineering Remediation Resources Group.
4585 Pacheco Boulevard
Suite 200
Martinez, California 94553-2233

Attn: Ms. Samantha C Knight

Authorized for release by:
11/30/2011 1:04:09 PM

Dimple Sharma
Project Manager I
dimple.sharma@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Definitions/Glossary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38394-1

Qualifiers

General Chemistry

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 720-38394-1

Laboratory: TestAmerica San Francisco

Narrative

Job Narrative
720-38394-1

Comments
No additional comments.

Receipt
All samples were received in good condition within temperature requirements.

Metals
No analytical or quality issues were noted.

General Chemistry
Method 9045C: The following sample was prepared and/or analyzed outside the method defined holding time because the request for the test was made after the holding time for the sample expired: MM-WP-4 (720-38394-5).

No other analytical or quality issues were noted.

Detection Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38394-1

Client Sample ID: MM-WP-4

Lab Sample ID: 720-38394-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	6.4		1.9		mg/Kg	4		6010B	Total/NA
Arsenic	5.5		3.8		mg/Kg	4		6010B	Total/NA
Barium	4.6		1.9		mg/Kg	4		6010B	Total/NA
Chromium	680		1.9		mg/Kg	4		6010B	Total/NA
Cobalt	130		0.76		mg/Kg	4		6010B	Total/NA
Copper	11		5.7		mg/Kg	4		6010B	Total/NA
Nickel	2300		1.9		mg/Kg	4		6010B	Total/NA
Vanadium	25		1.9		mg/Kg	4		6010B	Total/NA
Zinc	31		5.7		mg/Kg	4		6010B	Total/NA
Mercury	0.043		0.0090		mg/Kg	1		7471A	Total/NA

Analyte	Result	Qualifier	RL	RL	Unit	Dil Fac	D	Method	Prep Type
pH	7.45	H	0.100		SU	1		9045C	Soluble

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38394-1

Client Sample ID: MM-WP-4

Date Collected: 10/27/11 13:20
Date Received: 10/28/11 19:15

Lab Sample ID: 720-38394-5

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**6.4**		1.9		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Arsenic	**5.5**		3.8		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Barium	**4.6**		1.9		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Beryllium	ND		0.38		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Cadmium	ND		0.48		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Chromium	**680**		1.9		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Cobalt	**130**		0.76		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Copper	**11**		5.7		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Lead	ND		1.9		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Molybdenum	ND		1.9		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Nickel	**2300**		1.9		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Selenium	ND		3.8		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Silver	ND		0.95		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Thallium	ND		1.9		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Vanadium	**25**		1.9		mg/Kg		11/28/11 20:44	11/29/11 23:18	4
Zinc	**31**		5.7		mg/Kg		11/28/11 20:44	11/29/11 23:18	4

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.043**		0.0090		mg/Kg		11/22/11 20:23	11/23/11 09:31	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.45**	**H**	0.100		SU			11/29/11 14:00	1

QC Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38394-1

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 720-103585/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 103657 — **Prep Batch: 103585**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.50		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Arsenic	ND		1.0		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Barium	ND		0.50		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Beryllium	ND		0.10		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Cadmium	ND		0.13		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Chromium	ND		0.50		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Cobalt	ND		0.20		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Copper	ND		1.5		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Lead	ND		0.50		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Molybdenum	ND		0.50		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Nickel	ND		0.50		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Selenium	ND		1.0		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Silver	ND		0.25		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Thallium	ND		0.50		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Vanadium	ND		0.50		mg/Kg		11/28/11 20:44	11/29/11 22:40	1
Zinc	ND		1.5		mg/Kg		11/28/11 20:44	11/29/11 22:40	1

Lab Sample ID: LCS 720-103585/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 103657 — **Prep Batch: 103585**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	50.0	51.9		mg/Kg		104	80 - 120
Arsenic	50.0	53.0		mg/Kg		106	80 - 120
Barium	50.0	54.8		mg/Kg		110	80 - 120
Beryllium	50.0	53.3		mg/Kg		107	80 - 120
Cadmium	50.0	51.9		mg/Kg		104	80 - 120
Chromium	50.0	52.5		mg/Kg		105	80 - 120
Cobalt	50.0	53.6		mg/Kg		107	80 - 120
Copper	50.0	52.7		mg/Kg		105	80 - 120
Lead	50.0	52.6		mg/Kg		105	80 - 120
Molybdenum	50.0	53.0		mg/Kg		106	80 - 120
Nickel	50.0	52.7		mg/Kg		105	80 - 120
Selenium	50.0	52.1		mg/Kg		104	80 - 120
Silver	25.0	26.2		mg/Kg		105	80 - 120
Thallium	50.0	52.5		mg/Kg		105	80 - 120
Vanadium	50.0	51.9		mg/Kg		104	80 - 120
Zinc	50.0	53.0		mg/Kg		106	80 - 120

Lab Sample ID: LCSD 720-103585/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 103657 — **Prep Batch: 103585**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Antimony	50.0	52.7		mg/Kg		105	80 - 120	1	20
Arsenic	50.0	53.5		mg/Kg		107	80 - 120	1	20
Barium	50.0	55.0		mg/Kg		110	80 - 120	0	20
Beryllium	50.0	53.4		mg/Kg		107	80 - 120	0	20
Cadmium	50.0	52.5		mg/Kg		105	80 - 120	1	20
Chromium	50.0	52.9		mg/Kg		106	80 - 120	1	20

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: LCSD 720-103585/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 103657 — **Prep Batch: 103585**

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cobalt			50.0	54.0		mg/Kg		108	80 - 120	1	20
Copper			50.0	53.2		mg/Kg		106	80 - 120	1	20
Lead			50.0	53.1		mg/Kg		106	80 - 120	1	20
Molybdenum			50.0	53.6		mg/Kg		107	80 - 120	1	20
Nickel			50.0	53.3		mg/Kg		107	80 - 120	1	20
Selenium			50.0	52.7		mg/Kg		105	80 - 120	1	20
Silver			25.0	26.5		mg/Kg		106	80 - 120	1	20
Thallium			50.0	53.1		mg/Kg		106	80 - 120	1	20
Vanadium			50.0	52.5		mg/Kg		105	80 - 120	1	20
Zinc			50.0	53.5		mg/Kg		107	80 - 120	1	20

Method: 9045C - pH

Lab Sample ID: LCS 720-103627/1 — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 103627

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
pH			7.00	7.030		SU		100	99 - 101		

Lab Sample ID: 720-38394-5 DU — **Client Sample ID: MM-WP-4**
Matrix: Solid — **Prep Type: Soluble**
Analysis Batch: 103627

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	7.45	H		7.540		SU				1	20

QC Association Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38394-1

Metals

Prep Batch: 103415

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38394-5	MM-WP-4	Total/NA	Solid	7471A	

Analysis Batch: 103448

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38394-5	MM-WP-4	Total/NA	Solid	7471A	103415

Prep Batch: 103585

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38394-5	MM-WP-4	Total/NA	Solid	3050B	
LCS 720-103585/2-A	Lab Control Sample	Total/NA	Solid	3050B	
LCSD 720-103585/3-A	Lab Control Sample Dup	Total/NA	Solid	3050B	
MB 720-103585/1-A	Method Blank	Total/NA	Solid	3050B	

Analysis Batch: 103657

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38394-5	MM-WP-4	Total/NA	Solid	6010B	103585
LCS 720-103585/2-A	Lab Control Sample	Total/NA	Solid	6010B	103585
LCSD 720-103585/3-A	Lab Control Sample Dup	Total/NA	Solid	6010B	103585
MB 720-103585/1-A	Method Blank	Total/NA	Solid	6010B	103585

General Chemistry

Leach Batch: 103494

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38394-5	MM-WP-4	Soluble	Solid	DI Leach	
720-38394-5 DU	MM-WP-4	Soluble	Solid	DI Leach	

Analysis Batch: 103627

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38394-5	MM-WP-4	Soluble	Solid	9045C	
720-38394-5 DU	MM-WP-4	Soluble	Solid	9045C	
LCS 720-103627/1	Lab Control Sample	Total/NA	Solid	9045C	

Lab Chronicle

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38394-1

Client Sample ID: MM-WP-4

Lab Sample ID: 720-38394-5

Date Collected: 10/27/11 13:20

Matrix: Solid

Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	7471A			103415	11/22/11 20:23	CAM	TAL SF
Total/NA	Analysis	7471A		1	103448	11/23/11 09:31	EFH	TAL SF
Total/NA	Prep	3050B			103585	11/28/11 20:44	SK	TAL SF
Total/NA	Analysis	6010B		4	103657	11/29/11 23:18	BA	TAL SF
Soluble	Leach	DI Leach			103494	11/29/11 09:30	MJK	TAL SF
Soluble	Analysis	9045C		1	103627	11/29/11 14:00	MJK	TAL SF

Laboratory References:

TAL SF = TestAmerica San Francisco, 1220 Quarry Lane, Pleasanton, CA 94566, TEL (925)484-1919

Certification Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38394-1

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica San Francisco	California	State Program	9	2496

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

Method Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38394-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL SF
7471A	Mercury (CVAA)	SW846	TAL SF
9045C	pH	SW846	TAL SF

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SF = TestAmerica San Francisco, 1220 Quarry Lane, Pleasanton, CA 94566, TEL (925)484-1919

Sample Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38394-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
720-38394-5	MM-WP-4	Solid	10/27/11 13:20	10/28/11 19:15

134601

ERRG
Engineering / Remediation Resources Group, Inc.
115 Sasome St Suite 200
San Francisco CA, 94104
Phone: (925) 969-0750
Fax: (925) 969-0751

Lab No. 720-38394

Page 1 of 1

Chain-of-Custody Record and Analysis Request

Project Contact (Hardcopy or PDF To): Samantha.Knyntl@erg.com

California EDF Report? ☐ Yes ☐ No

Laboratory / Address: Test America inc

Electronic Deliverables To (Email Address):

Phone No.:

Fax No.:

Sampler: SCK / TA

Project Number: 2011-145

Phase # / Task #: 02.09

Project Name: Mammoth Mine

Project Address:

Project Manager:

Sample Designation	Date	Time	Container: 4oz Jar	Container: poly	Container: Vial	Matrix: Soil/Sediment	Matrix: Aq	Analysis Request: Cam 17 metals 6010B	Analysis Request: Paste pH 9045	Analysis Request: Hardness 200.7/6010	Analysis Request: TOC 5310	Analysis Request: HOLD	12 hr/ 24 hr/ 48 hr/ 72 hr/STD (1 wk) TAT	Number of Containers	Comments	For Lab Use Only
MM-SW-4	10/27/11	1220		1	3	X	X	X		X	X	X	STD	4		
MM-SW-5	10/27/11	1130		1	3		X	X		X	X	X	STD	4		
MM-SD4	10/27/11	1220	1			X		X	X			X	STD	1		
MM-SD-5	10/27/11	1130	1			X		X	X			X	STD	1		
MM-WP-H	10/27/11	1320	1			X		X	X			X		1		

Relinquished by:	Date	Time	Received by:
[signature]	10/28/11	1430	[signature]
[signature]	10/28/11	1915	
	10/28/11	1915	Joan Mullen

Remarks: Hold for analysis

4.5°C

11/30/2011

Login Sample Receipt Checklist

Client: Engineering Remediation Resources Group.

Job Number: 720-38394-1

Login Number: 38394

List Source: TestAmerica San Francisco

List Number: 1

Creator: Mullen, Joan

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	True	

TestAmerica

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ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Pleasanton
1220 Quarry Lane
Pleasanton, CA 94566
Tel: (925)484-1919

TestAmerica Job ID: 720-38393-2
Client Project/Site: Mammoth Mine
Revision: 1

For:
Engineering Remediation Resources Group.
4585 Pacheco Boulevard
Suite 200
Martinez, California 94553-2233

Attn: Ms. Samantha C Knight

Authorized for release by:
5/22/2012 3:59:54 PM

Dimple Sharma
Project Manager I
dimple.sharma@testamericainc.com

LINKS

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Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Definitions/Glossary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-2

Qualifiers

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 720-38393-2

Laboratory: TestAmerica Pleasanton

Narrative

Job Narrative
720-38393-2

Comments
No additional comments.

Receipt
All samples were received in good condition within temperature requirements.

Metals
No analytical or quality issues were noted.

Detection Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-2

Client Sample ID: MM-WP-1

Lab Sample ID: 720-38393-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.10	J	0.25	0.045	mg/L	2.5		6010B	STLC Citrate
Copper	920		0.50	0.093	mg/L	2.5		6010B	STLC Citrate

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-2

Client Sample ID: MM-WP-1

Lab Sample ID: 720-38393-7

Date Collected: 10/27/11 09:50

Matrix: Solid

Date Received: 10/28/11 19:15

Method: 6010B - Metals (ICP) - STLC Citrate

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.10	J	0.25	0.045	mg/L		11/28/11 09:59	11/28/11 22:00	2.5
Copper	920		0.50	0.093	mg/L		11/28/11 09:59	11/28/11 22:00	2.5

QC Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-2

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 720-103525/1-A
Matrix: Solid
Analysis Batch: 103577

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 103525

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.010	0.0018	mg/L		11/28/11 09:59	11/28/11 15:57	1
Copper	ND		0.020	0.0037	mg/L		11/28/11 09:59	11/28/11 15:57	1

Lab Sample ID: LCS 720-103525/2-A
Matrix: Solid
Analysis Batch: 103577

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 103525

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	1.00	1.01		mg/L		101	80 - 120
Copper	1.00	0.999		mg/L		100	80 - 120

Lab Sample ID: LCSD 720-103525/3-A
Matrix: Solid
Analysis Batch: 103577

Client Sample ID: Lab Control Sample Dup
Prep Type: Total Recoverable
Prep Batch: 103525

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	1.00	1.00		mg/L		100	80 - 120	1	20
Copper	1.00	0.992		mg/L		99	80 - 120	1	20

Lab Sample ID: LB4 720-103332/1-B LB4
Matrix: Solid
Analysis Batch: 103577

Client Sample ID: Method Blank
Prep Type: STLC Citrate
Prep Batch: 103525

Analyte	LB4 Result	LB4 Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.25	0.045	mg/L		11/28/11 09:59	11/28/11 16:48	2.5
Copper	ND		0.50	0.093	mg/L		11/28/11 09:59	11/28/11 16:48	2.5

QC Association Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-2

Metals

Leach Batch: 103332

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-7	MM-WP-1	STLC Citrate	Solid	CA WET Citrate	
LB4 720-103332/1-B LB4	Method Blank	STLC Citrate	Solid	CA WET Citrate	

Prep Batch: 103525

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-7	MM-WP-1	STLC Citrate	Solid	3005A	103332
LB4 720-103332/1-B LB4	Method Blank	STLC Citrate	Solid	3005A	103332
LCS 720-103525/2-A	Lab Control Sample	Total Recoverable	Solid	3005A	
LCSD 720-103525/3-A	Lab Control Sample Dup	Total Recoverable	Solid	3005A	
MB 720-103525/1-A	Method Blank	Total Recoverable	Solid	3005A	

Analysis Batch: 103577

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LB4 720-103332/1-B LB4	Method Blank	STLC Citrate	Solid	6010B	103525
LCS 720-103525/2-A	Lab Control Sample	Total Recoverable	Solid	6010B	103525
LCSD 720-103525/3-A	Lab Control Sample Dup	Total Recoverable	Solid	6010B	103525
MB 720-103525/1-A	Method Blank	Total Recoverable	Solid	6010B	103525

Analysis Batch: 103603

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-38393-7	MM-WP-1	STLC Citrate	Solid	6010B	103525

Lab Chronicle

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-2

Client Sample ID: MM-WP-1

Lab Sample ID: 720-38393-7

Date Collected: 10/27/11 09:50

Matrix: Solid

Date Received: 10/28/11 19:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
STLC Citrate	Leach	CA WET Citrate			103332	11/21/11 22:24	SK	TAL SF
STLC Citrate	Prep	3005A			103525	11/28/11 09:59	ET	TAL SF
STLC Citrate	Analysis	6010B		2.5	103603	11/28/11 22:00	BA	TAL SF

Laboratory References:

TAL SF = TestAmerica Pleasanton, 1220 Quarry Lane, Pleasanton, CA 94566, TEL (925)484-1919

Certification Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-2

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica Pleasanton	California	State Program	9	2496

Accreditation may not be offered or required for all methods and analytes reported in this package . Please contact your project manager for the laboratory's current list of certified methods and analytes.

Method Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-2

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL SF

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SF = TestAmerica Pleasanton, 1220 Quarry Lane, Pleasanton, CA 94566, TEL (925)484-1919

Sample Summary

Client: Engineering Remediation Resources Group.
Project/Site: Mammoth Mine

TestAmerica Job ID: 720-38393-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
720-38393-7	MM-WP-1	Solid	10/27/11 09:50	10/28/11 19:15

720-38393-2
720-38394 Rev.

Sharma, Dimple

From: Samantha Caruthers-Knight [samantha.caruthers-knight@errg.com]
Sent: Monday, November 21, 2011 2:47 PM
To: Sharma, Dimple
Subject: Files from 720-38393-1 Mammoth Mine

Please run sample MM-WP-4, for Mammoth Mine, for Cam 17 with mercury, and paste pH. Please also run STLC on MM-WP-1 (report 38393) for, arsenic and copper.

Also how long can you hold samples MM-SD-4 and MM-SD-5 for metals analysis?

From: Sharma, Dimple [mailto:dimple.sharma@testamericainc.com]
Sent: Friday, November 04, 2011 5:01 PM
To: Samantha Caruthers-Knight
Subject: Files from 720-38393-1 Mammoth Mine

DIMPLE SHARMA

TestAmerica San Francisco
THE LEADER IN ENVIRONMENTAL TESTING

Tel: 925.484.1919
www.testamericainc.com

Reference: [092848]
Attachments: 2

Login Sample Receipt Checklist

Client: Engineering Remediation Resources Group.

Job Number: 720-38393-2

Login Number: 38393

List Source: TestAmerica Pleasanton

List Number: 1

Creator: Mullen, Joan

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	True	

MICRO ANALYTICAL LABORATORIES, INC.

BULK ASBESTOS ANALYSIS - PLM ARB 435

1036
Samantha Knight
Engineering Remediation
Resources Group, Inc.
4585 Pacheco boulevard
Martinez, CA 94553

PROJECT:
SIX RIVERS
EE / CA
JOB NO. 2013-037

Micro Log In **188265**
Total Samples 2
Date Sampled 11/11/2013
Date Received 11/13/2013
Date Analyzed 11/14/2013

SAMPLE INFORMATION	ASBESTOS INFORMATION QUANTITY (AREA %) / TYPES / LAYERS / DISTINCT SAMPLES	DOMINANT OTHER MATERIALS
Client #: MM-WP Micro #: 188265-01 Analyst: SC WASTE SOIL Asb. / Total Pts. 5 / 400 Matrix Removed 0% Sensitivity 0.250%	1.25% CHRYSOTILE ASBESTOS	Matrix Type: ROCK FRAGMENTS, NON-FIBROUS SERPENTINE, CLAY

Technical Supervisor: Gamini Ranatunga, Ph.D. 2/21/2014 Date Reported

Analyses use Polarized Light Microscopy (PLM), Micro Analytical SOP PLM-101,Rev.1/4/2013 for building materials (based on EPA-600/R93-116 (1993)), and California ARB 435 (1991) for applicable soil, rock, or aggregate samples. NOTES: Weight % cannot be determined by PLM estimation or point counts. Asbestos fibers with diameter below ~1 μm may not be detected by PLM. The absence of asbestos in dust or debris (including wipe or microvacuum), and in some compact materials, including floor tiles, cannot be conclusively established by PLM, and should be confirmed by Transmission Electron Microscopy (TEM). Only dominant non-asbestos materials are indicated. This report must not be interpreted as a conclusive identification of non-asbestos (fibrous or not). Quantities of non-asbestos fibers are estimated, not point counted. Preparation (all samples): grinding, milling; teasing bundles apart; drying, if needed, by hotplate. Acid dissolution, ashing, or other matrix reduction techniques may be applied to some samples; residue asbestos % is corrected for amount of matrix removed. Various sample interferences may prevent detection of small asbestos fibers, and hinder determination of some optical properties. Notes are made if point counting is used; otherwise, asbestos is quantified by calibrated visual estimation. Detection limit is material dependent. Detection of asbestos traces (<<1%) may not be reliable or reproducible by PLM. Lower quantitation limit (reporting limit) of PLM estimation is 1%. The Cal-OSHA definition of asbestos-containing construction material is 0.1% asbestos by weight; however, reliable determination of asbestos weight percent at this level cannot be done by PLM, and TEM is recommended. Sample heterogeneity is indicated by listing more than one distinct layer or material on the report. Composite asbestos percentages on multilayered samples are applicable only to layered wall systems (wallboard, joint compound, and related materials); compositing is based on clients' descriptions of a material as "joint compound". Clients are solely responsible for identification and description of bulk materials listed on field forms. Laboratory sample descriptions may differ from descriptions given by the client. Quality Control (QC): all results have been determined to be within acceptance limits prior to reporting. Samples that were reanalyzed are denoted by two sets of analyst initials. Unless otherwise stated in this report, all samples were received in acceptable condition for analysis. This report must not be used to claim product endorsement by NIST or any U.S. Government agency. This report shall not be reproduced except in full without the approval of Micro Analytical Laboratories, Inc., and pertains only to the samples analyzed. ND = NO ASBESTOS DETECTED.

5900 HOLLIS STREET, SUITE M - EMERYVILLE, CA 94608 - (510) 653-0824

Client ID #

p 1 of 1

MICRO ANALYTICAL LABORATORIES, INC.

5900 Hollis St., Suite M, Emeryville, CA 94608

(510) 653-0824 - FAX (510) 653-1361 - www.labmicro.com

Chain of Custody 4/2/2013

Log in # 198265

Name / Client / Address: Samantha C Knight
ERRG Inc
115 Sansome st
San Francisco CA

Tel. 415 648-7100

E-mail Samantha.Knight@errg.com

Project: Six Rivers EE/CA

Job No. 2013-057

Number of Samples: 2

Turn-Around Time: Standard

Asbestos (TEM): AHERA Yamate II Mod. NIOSH 7402 CARB

Asbestos / Fibers: PCM PLM PLM-400 PLM-1200

Asbestos Soil/Rock: PLM CARB 435 400 pts. CARB 435 (Mod.) 1200 pts.

Lead / Metals: Air Paint Soil Wipe Water Bulk (TTLC) STLC TCLP

Mold / Fungi: Air (Spore Trap) Tape Lift Bulk Andersen Swab

Coliform: Presence / Absence MTF Sample Temperature (°C)

Other Analyses (Specify)

Micro ID # (For Lab Use Only)	Client Sample ID#	Description	Date Sampled	Time Sampled Start / Stop / Total Minutes	Average LPM	Total Liters	Wipe / Swab Sample Area
1	mm-wp	Waste Soil	11/11/13	: :			
2	HS-wp	Waste soil	11/12/13	: :			
				: :			
				: :			
				: :			
				: :			
				: :			
				: :			
				: :			
				: :			

Instructions / Comments: E-mail To:

Sample Return: YES NO If "YES" is checked, samples will be returned to the client or archived at Micro Analytical if required. If "NO" is checked, solid samples may be disposed of within three months (one week for liquid samples, lab suspensions, and digestates).

Sampler's Signature / Name: Samantha Carruthers Knight

Note to Lab: If any samples are not acceptable, record reasons for rejection.

Relinquished By: Drop Box / Courier Date / Time: Received By: 11/13/13 9:45 Date / Time

Relinquished By: Date / Time: Received By: Date / Time

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Pleasanton
1220 Quarry Lane
Pleasanton, CA 94566
Tel: (925)484-1919

TestAmerica Job ID: 720-53719-1
Client Project/Site: Six Rivers Nat'l Forest

For:
Engineering Remediation Resources Group.
115 Sansome Street
Suite 200
San Francisco, California 94104

Attn: Tiffany Angus

Authorized for release by:
11/20/2013 3:38:04 PM

Dimple Sharma, Senior Project Manager
(925)484-1919
dimple.sharma@testamericainc.com

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Job ID: 720-53719-1

Laboratory: TestAmerica Pleasanton

Narrative

Job Narrative
720-53719-1

Comments
No additional comments.

Receipt
The samples were received on 11/13/2013 4:20 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.3º C.

Metals
No analytical or quality issues were noted.

Organic Prep
No analytical or quality issues were noted.

Detection Summary

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Client Sample ID: MM-WP-03 — Lab Sample ID: 720-53719-1

No Detections.

Client Sample ID: MM-WP-01 — Lab Sample ID: 720-53719-2

No Detections.

Client Sample ID: MM-WP-02 — Lab Sample ID: 720-53719-3

No Detections.

Client Sample ID: HS-WP-01 — Lab Sample ID: 720-53719-4

No Detections.

Client Sample ID: HS-WP-02 — Lab Sample ID: 720-53719-5

No Detections.

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Client Sample ID: MM-WP-03

Lab Sample ID: 720-53719-1

Date Collected: 11/11/13 14:10

Matrix: Solid

Date Received: 11/13/13 16:20

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Copper	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:10	1
Arsenic	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:10	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Client Sample ID: MM-WP-01

Lab Sample ID: 720-53719-2

Date Collected: 11/11/13 14:40

Matrix: Solid

Date Received: 11/13/13 16:20

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Copper	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:14	1
Arsenic	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:14	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Client Sample ID: MM-WP-02

Lab Sample ID: 720-53719-3

Date Collected: 11/11/13 15:10

Matrix: Solid

Date Received: 11/13/13 16:20

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Copper	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:17	1
Arsenic	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:17	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Client Sample ID: HS-WP-01

Lab Sample ID: 720-53719-4

Date Collected: 11/12/13 09:00

Matrix: Solid

Date Received: 11/13/13 16:20

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Copper	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:19	1
Cobalt	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:19	1
Arsenic	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:19	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Client Sample ID: HS-WP-02

Lab Sample ID: 720-53719-5

Date Collected: 11/12/13 10:00

Matrix: Solid

Date Received: 11/13/13 16:20

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Copper	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:22	1
Cobalt	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:22	1
Arsenic	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:22	1

QC Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 440-144907/1-B — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: SPLP West**
Analysis Batch: 145375 — **Prep Batch: 144957**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Copper	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:05	1
Cobalt	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:05	1
Arsenic	ND		0.20		mg/L		11/17/13 17:05	11/19/13 10:05	1

Lab Sample ID: LCS 440-144907/2-B — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: SPLP West**
Analysis Batch: 145375 — **Prep Batch: 144957**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Copper	2.00	2.05		mg/L		102	80 - 120
Cobalt	2.00	2.02		mg/L		101	80 - 120
Arsenic	2.00	1.91		mg/L		95	80 - 120

Lab Sample ID: 720-53719-1 MS — **Client Sample ID: MM-WP-03**
Matrix: Solid — **Prep Type: SPLP West**
Analysis Batch: 145375 — **Prep Batch: 144957**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Copper	ND		2.00	1.98		mg/L		99	75 - 125
Cobalt	ND		2.00	1.96		mg/L		98	75 - 125
Arsenic	ND		2.00	1.85		mg/L		92	75 - 125

QC Association Summary

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Metals

Leach Batch: 144907

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-1	MM-WP-03	SPLP West	Solid	1312	
720-53719-1 MS	MM-WP-03	SPLP West	Solid	1312	
720-53719-2	MM-WP-01	SPLP West	Solid	1312	
720-53719-3	MM-WP-02	SPLP West	Solid	1312	
720-53719-4	HS-WP-01	SPLP West	Solid	1312	
720-53719-5	HS-WP-02	SPLP West	Solid	1312	
LCS 440-144907/2-B	Lab Control Sample	SPLP West	Solid	1312	
MB 440-144907/1-B	Method Blank	SPLP West	Solid	1312	

Prep Batch: 144957

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-1	MM-WP-03	SPLP West	Solid	3010A	144907
720-53719-1 MS	MM-WP-03	SPLP West	Solid	3010A	144907
720-53719-2	MM-WP-01	SPLP West	Solid	3010A	144907
720-53719-3	MM-WP-02	SPLP West	Solid	3010A	144907
720-53719-4	HS-WP-01	SPLP West	Solid	3010A	144907
720-53719-5	HS-WP-02	SPLP West	Solid	3010A	144907
LCS 440-144907/2-B	Lab Control Sample	SPLP West	Solid	3010A	144907
MB 440-144907/1-B	Method Blank	SPLP West	Solid	3010A	144907

Analysis Batch: 145375

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-1	MM-WP-03	SPLP West	Solid	6010B	144957
720-53719-1 MS	MM-WP-03	SPLP West	Solid	6010B	144957
720-53719-2	MM-WP-01	SPLP West	Solid	6010B	144957
720-53719-3	MM-WP-02	SPLP West	Solid	6010B	144957
720-53719-4	HS-WP-01	SPLP West	Solid	6010B	144957
720-53719-5	HS-WP-02	SPLP West	Solid	6010B	144957
LCS 440-144907/2-B	Lab Control Sample	SPLP West	Solid	6010B	144957
MB 440-144907/1-B	Method Blank	SPLP West	Solid	6010B	144957

Lab Chronicle

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Client Sample ID: MM-WP-03 — Lab Sample ID: 720-53719-1

Date Collected: 11/11/13 14:10 — **Matrix: Solid**
Date Received: 11/13/13 16:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			144907	11/16/13 23:31	CH	TAL IRV
SPLP West	Prep	3010A			144957	11/17/13 17:05	SN	TAL IRV
SPLP West	Analysis	6010B		1	145375	11/19/13 10:10	EN	TAL IRV

Client Sample ID: MM-WP-01 — Lab Sample ID: 720-53719-2

Date Collected: 11/11/13 14:40 — **Matrix: Solid**
Date Received: 11/13/13 16:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			144907	11/16/13 23:31	CH	TAL IRV
SPLP West	Prep	3010A			144957	11/17/13 17:05	SN	TAL IRV
SPLP West	Analysis	6010B		1	145375	11/19/13 10:14	EN	TAL IRV

Client Sample ID: MM-WP-02 — Lab Sample ID: 720-53719-3

Date Collected: 11/11/13 15:10 — **Matrix: Solid**
Date Received: 11/13/13 16:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			144907	11/16/13 23:31	CH	TAL IRV
SPLP West	Prep	3010A			144957	11/17/13 17:05	SN	TAL IRV
SPLP West	Analysis	6010B		1	145375	11/19/13 10:17	EN	TAL IRV

Client Sample ID: HS-WP-01 — Lab Sample ID: 720-53719-4

Date Collected: 11/12/13 09:00 — **Matrix: Solid**
Date Received: 11/13/13 16:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			144907	11/16/13 23:31	CH	TAL IRV
SPLP West	Prep	3010A			144957	11/17/13 17:05	SN	TAL IRV
SPLP West	Analysis	6010B		1	145375	11/19/13 10:19	EN	TAL IRV

Client Sample ID: HS-WP-02 — Lab Sample ID: 720-53719-5

Date Collected: 11/12/13 10:00 — **Matrix: Solid**
Date Received: 11/13/13 16:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			144907	11/16/13 23:31	CH	TAL IRV
SPLP West	Prep	3010A			144957	11/17/13 17:05	SN	TAL IRV
SPLP West	Analysis	6010B		1	145375	11/19/13 10:22	EN	TAL IRV

Laboratory References:

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022

Certification Summary

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Laboratory: TestAmerica Pleasanton

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
California	State Program	9	2496	01-31-14

Laboratory: TestAmerica Irvine

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska	State Program	10	CA01531	06-30-14
Arizona	State Program	9	AZ0671	10-13-14
California	LA Cty Sanitation Districts	9	10256	01-31-14
California	NELAP	9	1108CA	01-31-14
California	State Program	9	2706	06-30-14
Guam	State Program	9	Cert. No. 12.002r	01-28-14 *
Hawaii	State Program	9	N/A	01-31-14
Nevada	State Program	9	CA015312007A	07-31-14
New Mexico	State Program	6	N/A	01-31-14
Northern Mariana Islands	State Program	9	MP0002	01-31-14
Oregon	NELAP	10	4005	09-12-14
USDA	Federal		P330-09-00080	06-06-14
USEPA UCMR	Federal	1	CA01531	01-31-15

* Expired certification is currently pending renewal and is considered valid.

Method Summary

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL IRV

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022

Sample Summary

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
720-53719-1	MM-WP-03	Solid	11/11/13 14:10	11/13/13 16:20
720-53719-2	MM-WP-01	Solid	11/11/13 14:40	11/13/13 16:20
720-53719-3	MM-WP-02	Solid	11/11/13 15:10	11/13/13 16:20
720-53719-4	HS-WP-01	Solid	11/12/13 09:00	11/13/13 16:20
720-53719-5	HS-WP-02	Solid	11/12/13 10:00	11/13/13 16:20

150019

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ERRG Engineering / Remediation Resources Group, Inc.

Phone: 720-53719
Fax: :

Lab No. Test America
Address ~~Pleasanton CA~~

11/20/2013

Chain-of-Custody Record and Analysis Request

Project Contact (Hardcopy or PDF To): T. Angus	California EDF Report? / Navy EDD Report?
Laboratory: Test America	Electronic Deliverables To (Email Address): tiffany.angus@errg.com
Phone No.: 415-730-7658 / Fax No.:	Sampler: Tiffany Angus
Project Number: 2013-057 / Phase # / Task #	
Project Name: Mammoth - Hardscrabble	Project Address: ~~Eel River~~ Six Rivers Nat'l Forest
Project Manager:	

Sample Designation	Date	Time	Container: 8oz	Matrix: Soil	Matrix: Water	Analysis Request: SPLP - arsenic + copper	Analysis Request: SPLP - arsenic, copper + cobalt	12 hr/ 24 hr/ 48 hr/ 72 hr/STD (1 wk) TAT	Number of Containers	Comments	For Lab Use Only
MM-WP-03	11/11/13	1410	1	X		X		X	1		
MM-WP-01	11/11/13	1440	1	X		X		X	1		
MM-WP-02	11/11/13	1510	1	X		X		X	1		
HS-WP-01	11/12/13	0900	1	X			X	X	1		
HS-WP-02	11/12/13	1000	1	X			X	X	1		

720-53719 Chain of Custody

Relinquished by:	Date	Time	Received by:
[signature]	11/13/13	1442	[signature]
[signature]	11/13/13	1620	[signature]

Remarks:
MM-WP-01 through 03 - SPLP for As & Cu
HS-WP-01 & 02 - SPLP for As, Cu, & Co

Relinquished by: / Date / Time / Received by Laboratory:

Bill to: Engineering / Remediation Resources Group, Inc.
4585 Pacheco Blvd, Suite 200
Martinez, CA 94553

B.3°C

Login Sample Receipt Checklist

Client: Engineering Remediation Resources Group.

Job Number: 720-53719-1

Login Number: 53719
List Number: 1
Creator: Mullen, Joan

List Source: TestAmerica Pleasanton

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Login Sample Receipt Checklist

Client: Engineering Remediation Resources Group.

Job Number: 720-53719-1

Login Number: 53719
List Number: 1
Creator: Freitag, Kevin R

List Source: TestAmerica Irvine
List Creation: 11/15/13 02:26 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	N/A	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Pleasanton
1220 Quarry Lane
Pleasanton, CA 94566
Tel: (925)484-1919

TestAmerica Job ID: 720-53719-2
Client Project/Site: Six Rivers Nat'l Forest
Revision: 1

For:
Engineering Remediation Resources Group.
115 Sansome Street
Suite 200
San Francisco, California 94104

Attn: Tiffany Angus

Authorized for release by:
12/12/2013 12:57:35 PM

Dimple Sharma, Senior Project Manager
(925)484-1919
dimple.sharma@testamericainc.com

LINKS

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 720-53719-2

Laboratory: TestAmerica Pleasanton

Narrative

Job Narrative
720-53719-2

Comments
The report is revised to change the RLs.

Receipt
The samples were received on 11/13/2013 4:20 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.3º C.

Metals
No analytical or quality issues were noted.

Detection Summary

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Client Sample ID: MM-WP-03 — Lab Sample ID: 720-53719-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chromium	9.6		0.25		mg/L	2.5		6010B	STLC Citrate

Client Sample ID: MM-WP-01 — Lab Sample ID: 720-53719-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chromium	0.77		0.025		mg/L	2.5		6010B	STLC Citrate

Client Sample ID: MM-WP-02 — Lab Sample ID: 720-53719-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chromium	2.9		0.25		mg/L	2.5		6010B	STLC Citrate

Client Sample ID: HS-WP-01-02 — Lab Sample ID: 720-53719-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Lead	0.89		0.13		mg/L	2.5		6010B	STLC Citrate
Arsenic	0.57		0.25		mg/L	2.5		6010B	STLC Citrate
Chromium	6.9		0.25		mg/L	2.5		6010B	STLC Citrate
Cobalt	5.7		0.050		mg/L	2.5		6010B	STLC Citrate

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Client Sample ID: MM-WP-03

Lab Sample ID: 720-53719-1

Date Collected: 11/11/13 14:10

Matrix: Solid

Date Received: 11/13/13 16:20

Method: 6010B - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.25		mg/L		12/11/13 12:13	12/11/13 17:31	2.5
Chromium	ND		0.25		mg/L		12/11/13 12:13	12/11/13 17:31	2.5

Method: 6010B - Metals (ICP) - STLC Citrate

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.25		mg/L		12/09/13 15:31	12/10/13 20:36	2.5
Chromium	**9.6**		0.25		mg/L		12/09/13 15:31	12/10/13 20:36	2.5

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Client Sample ID: MM-WP-01

Lab Sample ID: 720-53719-2

Date Collected: 11/11/13 14:40

Matrix: Solid

Date Received: 11/13/13 16:20

Method: 6010B - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.50		mg/L		12/11/13 12:13	12/11/13 17:35	2.5
Chromium	ND		0.25		mg/L		12/11/13 12:13	12/11/13 17:35	2.5

Method: 6010B - Metals (ICP) - STLC Citrate

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.050		mg/L		12/09/13 16:11	12/10/13 20:41	2.5
Chromium	**0.77**		0.025		mg/L		12/09/13 16:11	12/10/13 20:41	2.5

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Client Sample ID: MM-WP-02

Lab Sample ID: 720-53719-3

Date Collected: 11/11/13 15:10

Matrix: Solid

Date Received: 11/13/13 16:20

Method: 6010B - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chromium	ND		0.25		mg/L		12/11/13 12:13	12/11/13 17:40	2.5

Method: 6010B - Metals (ICP) - STLC Citrate

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.50		mg/L		12/10/13 08:19	12/11/13 01:11	2.5
Chromium	**2.9**		0.25		mg/L		12/10/13 08:19	12/11/13 01:11	2.5

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Client Sample ID: HS-WP-01-02

Lab Sample ID: 720-53719-6

Date Collected: 11/12/13 09:00

Matrix: Solid

Date Received: 11/13/13 16:20

Method: 6010B - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.25		mg/L		12/11/13 12:13	12/11/13 17:44	2.5
Chromium	ND		0.25		mg/L		12/11/13 12:13	12/11/13 17:44	2.5

Method: 6010B - Metals (ICP) - STLC Citrate

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**0.89**		0.13		mg/L		12/10/13 08:20	12/11/13 01:24	2.5
Arsenic	**0.57**		0.25		mg/L		12/10/13 08:20	12/11/13 01:24	2.5
Chromium	**6.9**		0.25		mg/L		12/10/13 08:20	12/11/13 01:24	2.5
Cobalt	**5.7**		0.050		mg/L		12/10/13 08:20	12/11/13 01:24	2.5

QC Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 720-149868/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 149903 — **Prep Batch: 149868**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.010		mg/L		12/11/13 12:13	12/11/13 16:23	1
Selenium	ND		0.020		mg/L		12/11/13 12:13	12/11/13 16:23	1
Chromium	ND		0.010		mg/L		12/11/13 12:13	12/11/13 16:23	1

Lab Sample ID: LCS 720-149868/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 149903 — **Prep Batch: 149868**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	1.00	1.00		mg/L		100	80 - 120
Selenium	1.00	0.993		mg/L		99	80 - 120
Chromium	1.00	1.03		mg/L		103	80 - 120

Lab Sample ID: LCSD 720-149868/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 149903 — **Prep Batch: 149868**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	1.00	1.01		mg/L		101	80 - 120	0	20
Selenium	1.00	0.994		mg/L		99	80 - 120	0	20
Chromium	1.00	1.03		mg/L		103	80 - 120	0	20

Lab Sample ID: MB 720-149706/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total Recoverable**
Analysis Batch: 149828 — **Prep Batch: 149706**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.010		mg/L		12/09/13 15:31	12/10/13 18:29	1
Selenium	ND		0.020		mg/L		12/09/13 15:31	12/10/13 18:29	1
Chromium	ND		0.010		mg/L		12/09/13 15:31	12/10/13 18:29	1

Lab Sample ID: LCS 720-149706/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total Recoverable**
Analysis Batch: 149828 — **Prep Batch: 149706**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	1.00	0.975		mg/L		98	80 - 120
Selenium	1.00	0.999		mg/L		100	80 - 120
Chromium	1.00	0.988		mg/L		99	80 - 120

Lab Sample ID: LCSD 720-149706/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total Recoverable**
Analysis Batch: 149828 — **Prep Batch: 149706**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	1.00	0.981		mg/L		98	80 - 120	1	20
Selenium	1.00	0.993		mg/L		99	80 - 120	1	20
Chromium	1.00	0.982		mg/L		98	80 - 120	1	20

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: MB 720-149751/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total Recoverable**
Analysis Batch: 149847 — **Prep Batch: 149751**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.0050		mg/L		12/10/13 08:19	12/11/13 00:07	1
Arsenic	ND		0.010		mg/L		12/10/13 08:19	12/11/13 00:07	1
Selenium	ND		0.020		mg/L		12/10/13 08:19	12/11/13 00:07	1
Chromium	ND		0.010		mg/L		12/10/13 08:19	12/11/13 00:07	1
Cobalt	ND		0.0020		mg/L		12/10/13 08:19	12/11/13 00:07	1

Lab Sample ID: LCS 720-149751/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total Recoverable**
Analysis Batch: 149847 — **Prep Batch: 149751**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Lead	1.00	0.984		mg/L		98	80 - 120
Arsenic	1.00	0.969		mg/L		97	80 - 120
Selenium	1.00	0.974		mg/L		97	80 - 120
Chromium	1.00	0.973		mg/L		97	80 - 120
Cobalt	1.00	1.03		mg/L		103	80 - 120

Lab Sample ID: LCSD 720-149751/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total Recoverable**
Analysis Batch: 149847 — **Prep Batch: 149751**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	1.00	0.992		mg/L		99	80 - 120	1	20
Arsenic	1.00	0.976		mg/L		98	80 - 120	1	20
Selenium	1.00	0.980		mg/L		98	80 - 120	1	20
Chromium	1.00	0.974		mg/L		97	80 - 120	0	20
Cobalt	1.00	1.03		mg/L		103	80 - 120	0	20

Lab Sample ID: LB 720-149803/1-C LB — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 149903 — **Prep Batch: 149868**

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.25		mg/L		12/11/13 12:13	12/11/13 16:37	2.5
Selenium	ND		0.50		mg/L		12/11/13 12:13	12/11/13 16:37	2.5
Chromium	ND		0.25		mg/L		12/11/13 12:13	12/11/13 16:37	2.5

Lab Sample ID: LB4 720-149549/1-D LB4 — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: STLC Citrate**
Analysis Batch: 149828 — **Prep Batch: 149706**

Analyte	LB4 Result	LB4 Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.25		mg/L		12/09/13 15:31	12/10/13 19:46	2.5
Selenium	ND		0.50		mg/L		12/09/13 15:31	12/10/13 19:46	2.5
Chromium	ND		0.25		mg/L		12/09/13 15:31	12/10/13 19:46	2.5

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: LB4 720-149549/1-E LB4
Matrix: Solid
Analysis Batch: 149847

Client Sample ID: Method Blank
Prep Type: STLC Citrate
Prep Batch: 149751

Analyte	LB4 Result	LB4 Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.13		mg/L		12/10/13 08:19	12/11/13 01:06	2.5
Arsenic	ND		0.25		mg/L		12/10/13 08:19	12/11/13 01:06	2.5
Selenium	ND		0.50		mg/L		12/10/13 08:19	12/11/13 01:06	2.5
Chromium	ND		0.25		mg/L		12/10/13 08:19	12/11/13 01:06	2.5
Cobalt	ND		0.050		mg/L		12/10/13 08:19	12/11/13 01:06	2.5

QC Association Summary

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Metals

Leach Batch: 149549

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-1	MM-WP-03	STLC Citrate	Solid	CA WET Citrate	
720-53719-2	MM-WP-01	STLC Citrate	Solid	CA WET Citrate	
720-53719-3	MM-WP-02	STLC Citrate	Solid	CA WET Citrate	
720-53719-6	HS-WP-01-02	STLC Citrate	Solid	CA WET Citrate	
LB4 720-149549/1-D LB4	Method Blank	STLC Citrate	Solid	CA WET Citrate	
LB4 720-149549/1-E LB4	Method Blank	STLC Citrate	Solid	CA WET Citrate	

Prep Batch: 149706

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-1	MM-WP-03	STLC Citrate	Solid	3005A	149549
720-53719-2	MM-WP-01	STLC Citrate	Solid	3005A	149549
LB4 720-149549/1-D LB4	Method Blank	STLC Citrate	Solid	3005A	149549
LCS 720-149706/2-A	Lab Control Sample	Total Recoverable	Solid	3005A	
LCSD 720-149706/3-A	Lab Control Sample Dup	Total Recoverable	Solid	3005A	
MB 720-149706/1-A	Method Blank	Total Recoverable	Solid	3005A	

Prep Batch: 149751

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-3	MM-WP-02	STLC Citrate	Solid	3005A	149549
720-53719-6	HS-WP-01-02	STLC Citrate	Solid	3005A	149549
LB4 720-149549/1-E LB4	Method Blank	STLC Citrate	Solid	3005A	149549
LCS 720-149751/2-A	Lab Control Sample	Total Recoverable	Solid	3005A	
LCSD 720-149751/3-A	Lab Control Sample Dup	Total Recoverable	Solid	3005A	
MB 720-149751/1-A	Method Blank	Total Recoverable	Solid	3005A	

Leach Batch: 149803

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-1	MM-WP-03	TCLP	Solid	1311	
720-53719-2	MM-WP-01	TCLP	Solid	1311	
720-53719-3	MM-WP-02	TCLP	Solid	1311	
720-53719-6	HS-WP-01-02	TCLP	Solid	1311	
LB 720-149803/1-C LB	Method Blank	TCLP	Solid	1311	

Analysis Batch: 149828

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-1	MM-WP-03	STLC Citrate	Solid	6010B	149706
720-53719-2	MM-WP-01	STLC Citrate	Solid	6010B	149706
LB4 720-149549/1-D LB4	Method Blank	STLC Citrate	Solid	6010B	149706
LCS 720-149706/2-A	Lab Control Sample	Total Recoverable	Solid	6010B	149706
LCSD 720-149706/3-A	Lab Control Sample Dup	Total Recoverable	Solid	6010B	149706
MB 720-149706/1-A	Method Blank	Total Recoverable	Solid	6010B	149706

Analysis Batch: 149847

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-3	MM-WP-02	STLC Citrate	Solid	6010B	149751
720-53719-6	HS-WP-01-02	STLC Citrate	Solid	6010B	149751
LB4 720-149549/1-E LB4	Method Blank	STLC Citrate	Solid	6010B	149751
LCS 720-149751/2-A	Lab Control Sample	Total Recoverable	Solid	6010B	149751
LCSD 720-149751/3-A	Lab Control Sample Dup	Total Recoverable	Solid	6010B	149751
MB 720-149751/1-A	Method Blank	Total Recoverable	Solid	6010B	149751

Metals (Continued)

Prep Batch: 149868

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-1	MM-WP-03	TCLP	Solid	3010A	149803
720-53719-2	MM-WP-01	TCLP	Solid	3010A	149803
720-53719-3	MM-WP-02	TCLP	Solid	3010A	149803
720-53719-6	HS-WP-01-02	TCLP	Solid	3010A	149803
LB 720-149803/1-C LB	Method Blank	TCLP	Solid	3010A	149803
LCS 720-149868/2-A	Lab Control Sample	Total/NA	Solid	3010A	
LCSD 720-149868/3-A	Lab Control Sample Dup	Total/NA	Solid	3010A	
MB 720-149868/1-A	Method Blank	Total/NA	Solid	3010A	

Analysis Batch: 149903

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-53719-1	MM-WP-03	TCLP	Solid	6010B	149868
720-53719-2	MM-WP-01	TCLP	Solid	6010B	149868
720-53719-3	MM-WP-02	TCLP	Solid	6010B	149868
720-53719-6	HS-WP-01-02	TCLP	Solid	6010B	149868
LB 720-149803/1-C LB	Method Blank	TCLP	Solid	6010B	149868
LCS 720-149868/2-A	Lab Control Sample	Total/NA	Solid	6010B	149868
LCSD 720-149868/3-A	Lab Control Sample Dup	Total/NA	Solid	6010B	149868
MB 720-149868/1-A	Method Blank	Total/NA	Solid	6010B	149868

Lab Chronicle

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Client Sample ID: MM-WP-03 — Lab Sample ID: 720-53719-1

Date Collected: 11/11/13 14:10 — **Matrix: Solid**
Date Received: 11/13/13 16:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
STLC Citrate	Leach	CA WET Citrate			149549	12/07/13 09:33	ASB	TAL PLS
STLC Citrate	Prep	3005A			149706	12/09/13 15:31	ECT	TAL PLS
STLC Citrate	Analysis	6010B		2.5	149828	12/10/13 20:36	EFH	TAL PLS
TCLP	Leach	1311			149803	12/10/13 16:06	JCR	TAL PLS
TCLP	Prep	3010A			149868	12/11/13 12:13	JCR	TAL PLS
TCLP	Analysis	6010B		2.5	149903	12/11/13 17:31	SLK	TAL PLS

Client Sample ID: MM-WP-01 — Lab Sample ID: 720-53719-2

Date Collected: 11/11/13 14:40 — **Matrix: Solid**
Date Received: 11/13/13 16:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
STLC Citrate	Leach	CA WET Citrate			149549	12/07/13 09:33	ASB	TAL PLS
STLC Citrate	Prep	3005A			149706	12/09/13 16:11	ECT	TAL PLS
STLC Citrate	Analysis	6010B		2.5	149828	12/10/13 20:41	EFH	TAL PLS
TCLP	Leach	1311			149803	12/10/13 16:06	JCR	TAL PLS
TCLP	Prep	3010A			149868	12/11/13 12:13	JCR	TAL PLS
TCLP	Analysis	6010B		2.5	149903	12/11/13 17:35	SLK	TAL PLS

Client Sample ID: MM-WP-02 — Lab Sample ID: 720-53719-3

Date Collected: 11/11/13 15:10 — **Matrix: Solid**
Date Received: 11/13/13 16:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
STLC Citrate	Leach	CA WET Citrate			149549	12/07/13 09:33	ASB	TAL PLS
STLC Citrate	Prep	3005A			149751	12/10/13 08:19	JCR	TAL PLS
STLC Citrate	Analysis	6010B		2.5	149847	12/11/13 01:11	SLK	TAL PLS
TCLP	Leach	1311			149803	12/10/13 16:06	JCR	TAL PLS
TCLP	Prep	3010A			149868	12/11/13 12:13	JCR	TAL PLS
TCLP	Analysis	6010B		2.5	149903	12/11/13 17:40	SLK	TAL PLS

Client Sample ID: HS-WP-01-02 — Lab Sample ID: 720-53719-6

Date Collected: 11/12/13 09:00 — **Matrix: Solid**
Date Received: 11/13/13 16:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
STLC Citrate	Leach	CA WET Citrate			149549	12/07/13 09:33	ASB	TAL PLS
STLC Citrate	Prep	3005A			149751	12/10/13 08:20	JCR	TAL PLS
STLC Citrate	Analysis	6010B		2.5	149847	12/11/13 01:24	SLK	TAL PLS
TCLP	Leach	1311			149803	12/10/13 16:06	JCR	TAL PLS
TCLP	Prep	3010A			149868	12/11/13 12:13	JCR	TAL PLS
TCLP	Analysis	6010B		2.5	149903	12/11/13 17:44	SLK	TAL PLS

Lab Chronicle

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Laboratory References:

TAL PLS = TestAmerica Pleasanton, 1220 Quarry Lane, Pleasanton, CA 94566, TEL (925)484-1919

Certification Summary

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Laboratory: TestAmerica Pleasanton

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
California	State Program	9	2496	01-31-14

Method Summary

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL PLS

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL PLS = TestAmerica Pleasanton, 1220 Quarry Lane, Pleasanton, CA 94566, TEL (925)484-1919

Sample Summary

Client: Engineering Remediation Resources Group.
Project/Site: Six Rivers Nat'l Forest

TestAmerica Job ID: 720-53719-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
720-53719-1	MM-WP-03	Solid	11/11/13 14:10	11/13/13 16:20
720-53719-2	MM-WP-01	Solid	11/11/13 14:40	11/13/13 16:20
720-53719-3	MM-WP-02	Solid	11/11/13 15:10	11/13/13 16:20
720-53719-6	HS-WP-01-02	Solid	11/12/13 09:00	11/13/13 16:20

720-53719-2

Sharma, Dimple

From: Samantha Caruthers-Knight [Samantha.Caruthers-Knight@errg.com]
Sent: Wednesday, December 04, 2013 4:19 PM
To: Sharma, Dimple
Subject: RE: STLC and TCLP

It was great seeing you today! I think I finally figured out what I want to do with those Six Rivers samples from a few weeks ago.

Ideally I'd like to run the following tests, please let me know if you will have enough volume. If you do not have enough volume for both extractions for the MM samples we can discuss compositing those as well.

MM-WP-01
STCL: Cr, Se
TCLP: Cr, Se

MM-WP-02
STLC: Cr, Se
TCLP: Cr

MM-WP-03
STLC: As, Cr
TCLP: As, Cr

Composite HS-WP-01 and HS-WP-02
STLC: As, Cr, Co, Pb
TCLP: As, Cr

720-53719 Chain of Custody

From: Sharma, Dimple [mailto:Dimple.Sharma@testamericainc.com]
Sent: Wednesday, November 20, 2013 2:53 PM
To: Samantha Caruthers-Knight
Subject: RE: STLC and TCLP

Hi Samantha,
We received the sample back and we have enough to do the STLC analysis. Please let me know which sample to analyze for what analysis.

Thanks.

Dimple Sharma
Senior Project Manager

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

1220 Quarry Lane
Pleasanton, CA 94566
Tel 925.484.1919 ext. 103 | Fax 925.600.3002
www.testamericainc.com

Login Sample Receipt Checklist

Client: Engineering Remediation Resources Group.

Job Number: 720-53719-2

Login Number: 53719

List Source: TestAmerica Pleasanton

List Number: 1

Creator: Mullen, Joan

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Appendix D. Altaville Mining District Background Metals Evaluation

Section 1. Introduction

Metals occur naturally in rock and soil at highly varied concentrations depending on the geology of the area. While regulatory standards and risk-based screening levels must be considered in the development of cleanup goals, U.S. Environmental Protection Agency (EPA) guidance and policy do not recommend that cleanup goals be established at concentrations less than background, even if the background concentration exceeds a risk-based screening level (EPA, 2002). As a result, establishing a background soil concentration for naturally occurring metals is critical to conducting environmental investigations. While a full-scale background study (e.g., Department of Toxic Substances Control, 2013; EPA, 2002) was not conducted for the Altaville Mining District Site, background soil samples collected from several mines within the site were compiled and evaluated to establish representative background soil concentrations for use in evaluating areas of contamination (AOCs) within the site.

1.1. DATA COMPILATION

Background soil data have previously been collected from four different AOCs (Aurora, Hardscrabble, Mammoth, and Union-Zaar mines) within the site. These samples were collected upgradient from mine workings at each AOC and represent the naturally occurring background conditions. Figure D-1 shows the background sample locations. The previous studies conducted at each AOC are listed below.

- **Aurora Mine AOC.** In September 2012, background soil samples were collected upgradient of the Aurora Mine AOC as part of the PA/SI (Engineering/Remediation Resources Group, Inc. [ERRG], 2013).
- **Hardscrabble Mine AOC.** In July 2007, background soil samples were collected as part of the PA/SI from upgradient of the Hardscrabble Mine AOC (Science Applications International Corporation [SAIC], 2007).
- **Mammoth Mine AOC.** In October 2011, background soil samples were collected as part of the PA/SI from upgradient of the Mammoth Mine AOC (ERRG, 2012).
- **Union-Zaar Mine AOC.** In May 2007, background soil samples were collected as part of the PA/SI from upgradient of the Union-Zaar AOC (ERRG, 2008).

Table D-1 presents available background data for soil.

1.2. DATA EVALUATION

The average (arithmetic mean) of all onsite background soil data was calculated for each metal analyzed based on the "Preliminary Endangerment Assessment Guidance Manual" (Department of Toxic Substances Control, 2013). To ensure that outliers did not skew the data, some values (outliers) were eliminated from the data set. Outliers were defined as concentrations that were at least one order of magnitude greater or less than the remainder of the data set. These were flagged, as presented on Table D-1. To ensure that the background values were not skewed to appear higher than they are and therefore obscure possible contamination when used as a screening tool, flagged values greater than the remainder of the data set (shown in red on Table D-1) were removed. Flagged values less than the remainder of the data set (shown in blue) were retained.

Where an analyte was not detected, one-half of the laboratory reporting limit was used in calculating the average. Table D-1 presents the nondetects and reporting limits. For metals that were not detected in any of the background samples collected, a range of the reporting limits was used as the screening criteria. Table D-2 presents the data set used to calculate background values and the background values.

Finally, background data compiled for the Altaville Mining District Site were compared with published regional background values collected and evaluated by the U.S. Geological Survey (Gustavson, et al., 2001) (Tables D-2).

1.3. CONCLUSIONS

The background evaluation concluded that background concentrations in soil were relatively consistent across the AOCs and the average concentrations (presented in Table 4) are appropriate for use in screening soil, tailings, and waste rock samples collected from AOCs within the Altaville Mining District.

Section 2. References

Department of Toxic Substances Control, 2013. "Preliminary Endangerment Assessment Guidance Manual." January 1994, Revised October.

Engineering/Remediation Resources Group, Inc. (ERRG), 2008. "Engineering Evaluation/Cost Assessment (EE/CA) for the Union-Zaar Mine, Six Rivers National Forest, Del Norte County, California." February.

ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

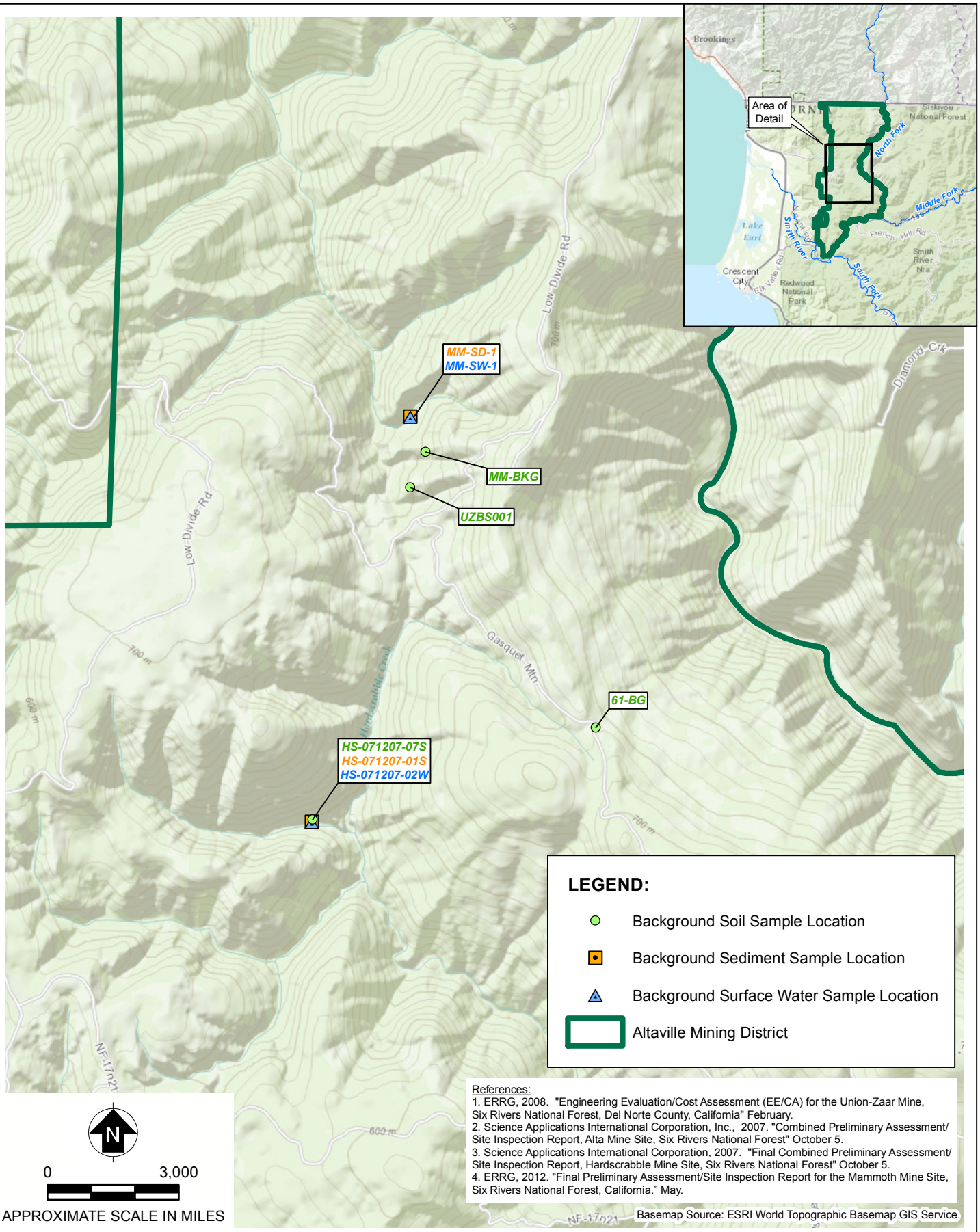
ERRG, 2013. "Preliminary Assessment/Site Inspection Report for the Aurora Mine Site, Six Rivers National Forest." January.

Gustavson, N., B. Bolviken, D.B. Smith, and R.C. Severson., 2001. "Geochemical Landscapes of the Conterminous United States, New Map Presentations for 22 Elements." *USGS Professional Paper 1648.* 44 pages.

Science Applications International Corporation, Inc. (SAIC), 2007. "Final Combined Preliminary Assessment / Site Inspection Report, Hardscrabble Mine Site, Six Rivers National Forest." October 5.

U.S. Environmental Protection Agency (EPA), 2002. "Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites." OSWER Directive 9285.7-41. September. Available Online at: <http://www.epa.gov/oswer/riskassessment/pdf/background.pdf/>.

Figure



References:
1. ERRG, 2008. "Engineering Evaluation/Cost Assessment (EE/CA) for the Union-Zaar Mine, Six Rivers National Forest, Del Norte County, California" February.
2. Science Applications International Corporation, Inc., 2007. "Combined Preliminary Assessment/ Site Inspection Report, Alta Mine Site, Six Rivers National Forest" October 5.
3. Science Applications International Corporation, 2007. "Final Combined Preliminary Assessment/ Site Inspection Report, Hardscrabble Mine Site, Six Rivers National Forest" October 5.
4. ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

W:\2013\2013-057 USFS Mammoth and Hardscrabble\Mammoth EECA\Background Sample Locations_v1.mxd Last updated: 4/15/2014 at 1:27:37 PM

ERRG
Engineering/Remediation Resources Group, Inc.
115 Sansome Street, Suite 200
San Francisco, CA 94104
(415) 395-9974

CLIENT: U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE	BACKGROUND SAMPLE LOCATIONS			
LOCATION: MAMMOTH MINE SIX RIVERS NATIONAL FOREST, CA	DRAWN BY: MKH 4/15/14	CHECKED BY: SCK 4/15/14	ERRG PROJECT NO. 2013-057	FIG NO. D-1

Tables

Table D-1. Regional Background Metals Concentrations in Soil (mg/kg)

Sample ID No.	Site Location	Date	Al	Sb	Ar	Ba	Be	Cd	Total Cr	Co	Cu	Pb	Mn	Hg	Mo	Ni	Se	Ag	Th	Va	Zn
UZBS001[1]	Union-Zaar Mine	May-07	7,020	6.6J	<1.5	27.8J	<0.05	<0.34	1,450	209	17.4	<1.9	2,300	0.025J	<0.14	2,880	9.1	<0.03	<5.6	38.2J	45.4J
HS-071207-07S[2]	Hardscrabble Mine	Jul-07	8,800	**50**	<40	27	**5.4**	<0.5	1,790	308	18	9	2,490	0.06	NS	3,750	<40	<10	<30	54.2	98
MM-BKG[3]	Mammoth Mine	Oct-11	NS	6.7	9.1	39	<0.38	<0.48	1,100	240	23	<1.9	NS	0.011	<1.9	2,800	<3.8	<0.96	2	37	75
61-Bg[4]	Aurora Mine	September-12	NS	2.9J	<5.2	<52	<2.6	<0.039[5]	1,270	175	<6.5	8.1	NS	**0.00039J**	<5.2	1,950	<0.61[6]	<2.6	3.0J	32.4	22.7

Notes:

Red values are outliers that will be removed

Blue values are ouliers that will be retained

1 = ERRG, 2008. "Engineering Evaluation/Cost Assessment (EE/CA) for the Union-Zaar Mine, Six Rivers National Forest, Del Norte County, California" February.

2 = Science Applications International Corporation, 2007a. "Final Combined Preliminary Assessment / Site Inspection Report, Hardscrabble Mine Site, Six Rivers National Forest" October 5.

3 = ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

4 = ERRG, 2013. "Preliminary Assessment/Site Inspection Report for the Aurora Mine Site, Six Rivers National Forest" January.

5 = not detected above the minimum detection limit.

ERRG = Engineering/Remediation Resources Group, Inc.

ID = identification

J = concentration is an estimated value, detected between the reporting limit and the minimum detection limit

mg/kg = milligrams per kilogram

NS = not sampled

< = not detected above the reporting limit

Al = Aluminum	Cu = Copper	Se = Selenium
Sb = Antimony	Pb = Lead	Ag = Silver
Ar = Arsenic	Mn = Manganese	Th = Thallium
Ba = Barium	Hg = Mercury	Va = Vanadium
Be = Beryllium	Mo = Molybdenum	Zn = Zinc
Cd = Cadmium	Ni = Nickel	

Table D-2. Calculation of Average Background Values for Metals in Soil (mg/kg)

Sample ID No.	Site Location	Date	Al	Sb	Ar	Ba	Be	Cd	Total Cr	Co	Cu	Pb	Mn	Hg	Mo	Ni	Se	Ag	Th	Va	Zn
UZBS001[1]	Union-Zaar Mine	May-07	7,020	6.6	0.75	27.8	0.025	<0.34	1,450	209	17	0.95	NS	0.025	<0.14	2,880	9.1	<0.03	2.8	38.2	45.4
HS-071207-07S[2]	Hardscrabble Mine	Jul-07	8,800	--	20	27	--	<0.5	1,790	308	18	9	2,490	0.06	NS	3,750	20	<10	15	54.2	98
MM-BKG[3]	Mammoth Mine	Oct-11	--	6.7	9.1	39	0.19	<0.48	1,100	240	23	0.95	NS	0.011	<1.9	2,800	1.9	<0.96	2	37	75
61-Bg[4]	Aurora Mine	September-12	--	2.9	2.6	26	1.3	<0.039	1,270	175	3	8.1	NS	0.00039	<5.2	1,950	0.305	<2.6	3	32.4	22.7
Average Background[5]			**7,910**	**5.4**	**8**	**30**	**0.5**	**<0.039 to <0.5[7]**	**1,403**	**233**	**15**	**5**	**2,490**	**0.02**	**<0.14 to <5.2[7]**	**2,845**	**8**	**<0.03 to <10[7]**	**6**	**40**	**60**
Regional Background[6]			10	1	3.11	700	1	--	500	20	70	15	1,000	0.08	3	100	1	--	7.2	200	102

Notes:

[1]ERRG, 2008. "Engineering Evaluation/Cost Assessment (EE/CA) for the Union-Zaar Mine, Six Rivers National Forest, Del Norte County, California" February.

[2]Science Applications International Corporation, 2007a. "Final Combined Preliminary Assessment / Site Inspection Report, Hardscrabble Mine Site, Six Rivers National Forest" October 5.

[3]ERRG, 2012. "Final Preliminary Assessment/Site Inspection Report for the Mammoth Mine Site, Six Rivers National Forest, California." May.

[4]ERRG, 2013. "Preliminary Assessment/Site Inspection Report for the Aurora Mine Site, Six Rivers National Forest" January.

[5]The average was calculated using one half the reporting limit when an analyte was not detected. In order to maintain a conservative comparison, outliers which increas the background value signifigantly were removed from the data set.

[6] Gustavson, et al., 2001. "Geochemical Landscapes of the Conterminous United States, New Map Presentations for 22 Elements." USGS Professional Paper 1648.

[7] For analytes with no detections the range of reporting limits was used

ERRG = Engineering/Remediation Resources Group, Inc.

ID = identification

mg/kg = milligrams per kilogram

NS = not sampled

< = not detected above the reporting limit

-- value removed as an outlier

Al = Aluminum	Cu = Copper	Se = Selenium
Sb = Antimony	Pb = Lead	Ag = Silver
Ar = Arsenic	Mn = Manganese	Th = Thallium
Ba = Barium	Hg = Mercury	Va = Vanadium
Be = Beryllium	Mo = Molybdenum	Zn = Zinc
Cd = Cadmium	Ni = Nickel	

Appendix E. Removal Action Cost Estimate

Table E-1. Alternatives Cost Estimate Summary

Site: Mammoth Mine AOC
Location: Six Rivers National Forest, Del Norte County, California
Phase: EE/CA (-30% / +50%)

Remedial Alternative	Total Capital Cost	Total O&M Cost (30 Years)	Total Periodic Cost	Period of Analysis(2)	Total Cost(3)	Present Value Cost(4)	Range for -30% / +50%
1	$ -	$ -	$ -	30 years	$ -	$ -	$ - to $ -
2	$ 673,000	$ 12,000	$ 14,400	30 years	$ 699,400	$ 696,500	$ 487,550 to $ 1,044,750
3	$ 761,500	$ 12,000	$ 14,400	30 years	$ 787,900	$ 785,000	$ 549,500 to $ 1,177,500
4	$ 875,200	$ 2,000	$ -	5 year	$ 877,200	$ 877,100	$ 613,970 to $ 1,315,650

Notes:

(1) Appended tables summarize backup calculations for all cost estimates provided.

(2) Period of analysis assumes the base year is 2014.

(3) Total cost includes a 25 percent contingency factor to account for changes in scope, changes to bid quantities, and inflation.

(4) Based on a 1.9 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2013) at http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.

Table E-2. Alternative 2 - Cost Summary

Site: Mammoth Mine AOC

Description: Alternative 2 (Removal and Onsite Encapsulation [at the AOC])
Cost Summary for the Mammoth Mine AOC EE/CA

Location: Six Rivers National Forest, Del Norte County, California

CAPITAL COSTS:					
DESCRIPTION	**QTY**	**UNIT**	**UNIT COST**	**TOTAL**	**SOURCE/NOTES[1]**
Field Planning and Design Documents	1	LS	$39,500.00	$39,500	Includes three weeks for technical staff to complete a design and pre-mobilization plans (including Work Plan including a habitat and vegetation management plan and HASP with graphics, review, and production). Design costs include a site survey, one site visit for tech staff.
Mobilization and Demobilization	1	LS	$98,800.00	$98,800	Mobilization and demobilization of crew of 6 personnel, materials, and 4 pieces of equipment. Includes costs for sanitary facilities, and other project necessities. This task includes labor for project managment and invoicing.
Site Work					
Clear, Grub, and Road Repair	1	LS	$100,800.00	$100,800	Assumes the mine access road will require minor road repairs and minimal clearing of a path from the mine access road to waste pile 1 and 2 to allow for access of tracked equipment. Includes 4 pieces of equipment and a crew of 6 with per diem for all site workers. Assumes 10 days of work.
Excavate Source Materials and Haul to Repository	365	CY	$290.14	$105,900	Assumes approximately 365 cubic yards of soil from waste pile 1, 2, and 3 will be removed using a long neck excavator and transported to the repository area near waste pile 3. Waste rock will be placed into a tracked dump truck which will transport the waste rock to the repository location. The repository is approximately 800 feet from waste pile 1 and 2. Includes 3 pieces of equipment and a crew of 6 with per diem for all site workers. Assumes 9 days of work.
Encapsulation	1	LS	$58,300.00	$58,300	Assumes approximately 424 cubic yards of clean cover soil to construct a 2 foot thick cap. Assume clean cover soil is from an on-site source. Assume 192 cubic yards per day may be placed and compacted. Includes 5 pieces of equipment and a crew of 6 with per diem for all site workers. Assumes 4 days of work.
Restoration	1	LS	$17,200.00	$17,200	Includes installation of erosion control measures (such as rolled erosion control mats and blankets, jute mesh, straw wattle) on the cap and all other disturbed areas and hydroseeding on the cap, Assumes 2 days to install.
After Action Report	1	LS	$9,800	$9,800.00	Includes 2 weeks for technical staff to write a completion report, including graphics, review, and production. Also includes a final site survey to provide data for as-built drawings.
SUBTOTAL				**$430,300**	
Contingency	25%			$107,575.00	15% scope + 10% bid
SUBTOTAL				**$537,875**	
Project Management	10%			$43,030.00	Includes project management during all phases of construction, regulatory interface, and permitting.
Construction Management	12%			$51,636.00	Includes construction management, quality control, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$673,000**	

Table E-2. Alternative 2 - Cost Summary *(continued)*

Site: Mammoth Mine AOC

Description: Alternative 2 (Removal and Onsite Encapsulation [at the AOC])
Cost Summary for the Mammoth Mine AOC EE/CA

Location: Six Rivers National Forest, Del Norte County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES[1]
Inspections and Maintenance					
Annual Inspections	1	LS	$ 300	$ 300	Annual inspection to be performed by Gasquet Forest Service Ranger to evaluate the integrity of all cover elements and storm water BMPs.
SUBTOTAL				**$300**	
Contingency	25%			$ 75	10% scope + 15% bid
		TOTAL ANNUAL O&M COSTS:		**$400**	per year
		TOTAL ANNUAL O&M COSTS:		**$12,000.00**	Years 1-30

PERIODIC COSTS	Year	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES[1]
Five-Year Review Report	5	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 5.
SUBTOTAL (YEAR 5)					**$2,500.00**	
Five-Year Review Report	10	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 10.
Minor Repairs	10	1	LS	$4,200	$4,200.00	Costs for cap repairs
SUBTOTAL (YEAR 10)					**$6,700.00**	
Five-Year Review Report	15	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 15.
SUBTOTAL (YEAR 15)					**$2,500.00**	
Five-Year Review Report	20	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 20.
SUBTOTAL (YEAR 20)					**$2,500.00**	
Five-Year Review Report	15	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 25.
SUBTOTAL (YEAR 25)					**$2,500.00**	
Five-Year Review Report	20	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 30.
SUBTOTAL (YEAR 30)					**$2,500.00**	

Table E-2. Alternative 2 - Cost Summary *(continued)*

Site: Mammoth Mine AOC

Description: Alternative 2 (Removal and Onsite Encapsulation [at the AOC])
Cost Summary for the Mammoth Mine AOC EE/CA

Location: Six Rivers National Forest, Del Norte County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES[1]

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)[1]	PRESENT VALUE
Capital Cost	0	$ 673,000	$ 673,000	1.000	$ 673,000
Annual O&M Cost	1-30	$ 12,000.00	$ 400	0.757	$9,083.00
Periodic Cost	5	$ 2,500.00	$ 2,500	0.910	$ 2,275
Periodic Cost	10	$ 6,700.00	$ 6,700	0.828	$ 5,551
Periodic Cost	15	$ 2,500.00	$ 2,500	0.754	$ 1,885
Periodic Cost	20	$ 2,500.00	$ 2,500	0.686	$ 1,716
Periodic Cost	25	$ 2,500.00	$ 2,500	0.625	$ 1,562
Periodic Cost	30	$ 2,500.00	$ 2,500	0.569	$ 1,421
		$ 704,200.00			$ 696,500

TOTAL PRESENT VALUE OF SELECTED REMEDY **$696,500**

Notes:

(1) Based on a 1.9 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2013) at http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.

ARIC = Area Requiring Institutional Controls

BMPs = best management practices

cy = cubic yard

LS = lump sum

O&M = operation and maintenance

SF = square feet

Table E-3. Alternative 2 - Present Value Analysis

Year	Periodic Cost	Annual Cost	Discount Factor[1]	Actual Periodic Cost	Actual Annual Cost
1		$400	0.981354269		$392.54
2		$400	0.963056201		$385.22
3		$400	0.945099314		$378.04
4		$400	0.927477246		$370.99
5	$2,500	$400	0.910183755	$2,275.46	$364.07
6		$400	0.893212714		$357.29
7		$400	0.876558109		$350.62
8		$400	0.860214043		$344.09
9		$400	0.844174723		$337.67
10	$6,700	$400	0.828434468	$5,550.51	$331.37
11		$400	0.812987702		$325.20
12		$400	0.797828952		$319.13
13		$400	0.782952847		$313.18
14		$400	0.768354119		$307.34
15	$2,500	$400	0.754027595	$1,885.07	$301.61
16		$400	0.739968199		$295.99
17		$400	0.726170951		$290.47
18		$400	0.712630963		$285.05
19		$400	0.699343437		$279.74
20	$2,500	$400	0.686303668	$1,715.76	$274.52
21		$400	0.673507034		$269.40
22		$400	0.660949003		$264.38
23		$400	0.648625126		$259.45
24		$400	0.636531036		$254.61
25	$2,500	$400	0.624662449	$1,561.66	$249.86
26		$400	0.613015161		$245.21
27		$400	0.601585046		$240.63
28		$400	0.590368053		$236.15
29		$400	0.579360209		$231.74
30	$2,500	$400	0.568557614	$1,421.39	$227.42

Notes:

(1) Based on a 1.9 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2013) at http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.

Table E-4. Alternative 3 - Cost Summary

Site: Mammoth Mine AOC

Description: Alternative 3 (Removal and Onsite Encapsulation [within the Altaville Mining District, near the AOC])
Cost Summary for the Mammoth Mine AOC EE/CA

Location: Six Rivers National Forest, Del Norte County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES[1]
Field Planning and Design Documents	1	LS	$39,500.00	$39,500	Includes three weeks for technical staff to complete a design and pre-mobilization plans (including Work Plan including a habitat and vegetation management plan and HASP with graphics, review, and production). Design costs include a site survey, one site visit for tech staff.
Mobilization and Demobilization	1	LS	$118,900.00	$118,900	Mobilization and demobilization of crew of 7 personnel, materials, and 6 pieces of equipment. Includes costs for sanitary facilities, and other project necessities. Includes per diem for all site workers. This task includes labor for project managment and invoicing.
Site Work					
Clear, Grub, and Road Repair	1.0	LS	$121,600.00	$121,600	Assumes the mine access road will require minor road repairs and minimal clearing of a path from the mine access road to waste pile 1 and 2 to allow for access of tracked equipment. Includes 4 pieces of equipment and a crew of 7 with per diem for all site workers. Assumes 10 days of work.
Excavate Source Materials and Haul to Repository	365	CY	$372.33	$135,900	Assumes approximately 365 cubic yards of soil from waste pile 1, 2, and 3 will be removed and transported to the repository area. The repository is approximately 1 mile from waste piles 1, 2, and 3. Includes 5 pieces of equipment and a crew of 7 with per diem for all site workers. Assumes 9 days of work.
Encapsulation	1	LS	$47,200.00	$47,200	Assumes approximately 424 cubic yards of clean cover soil to construct a 2 foot thick cap. Assume clean cover soil is from an on-site source. Assume 192 cubic yards per day may be placed and compacted. Includes 6 pieces of equipment and a crew of 7 with per diem for all site workers. Assumes 2 days of work.
Restoration	1	LS	$17,600.00	$17,600	Includes installation of erosion control measures (such as rolled erosion control mats and blankets, jute mesh, straw wattle) on the cap and all other disturbed areas and hydroseeding on the cap. Assumes 2 days to install.
After Action Report	1	LS	$9,800	$9,800.00	Includes 2 weeks for technical staff to write a completion report, including graphics, review, and production. Also includes a final site survey to provide data for as-built drawings.
SUBTOTAL				**$490,500**	
Contingency	25%			$122,625.00	15% scope + 10% bid
SUBTOTAL				**$613,125**	
Project Management	10%			$49,050.00	Includes project management during all phases of construction, regulatory interface, and permitting.
Construction Management	12%			$58,860.00	Includes construction management, quality control, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$761,500**	

Table E-4. Alternative 3 - Cost Summary *(continued)*

Site: Mammoth Mine AOC

Description: Alternative 3 (Removal and Onsite Encapsulation [within the Altaville Mining District, near the AOC])
Cost Summary for the Mammoth Mine AOC EE/CA

Location: Six Rivers National Forest, Del Norte County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES[1]
Inspections and Maintenance					
Annual Inspections	1	LS	$ 300	$ 300	Annual inspection to be performed by Gasquet Forest Service Ranger to evaluate the integrity of all cover elements and storm water BMPs.
SUBTOTAL				**$300**	
Contingency	25%			$ 75	10% scope + 15% bid
		TOTAL ANNUAL O&M COSTS:		**$400**	per year
		TOTAL ANNUAL O&M COSTS:		**$12,000.00**	Years 1-30

PERIODIC COSTS	Year	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES[1]
Five-Year Review Report	5	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 5.
SUBTOTAL (YEAR 5)					**$2,500.00**	
Five-Year Review Report	10	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 10.
Minor Repairs	10	1	LS	$4,200	$4,200.00	Costs for cap repairs
SUBTOTAL (YEAR 10)					**$6,700.00**	
Five-Year Review Report	15	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 15.
SUBTOTAL (YEAR 15)					**$2,500.00**	
Five-Year Review Report	20	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 20.
SUBTOTAL (YEAR 20)					**$2,500.00**	
Five-Year Review Report	15	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 25.
SUBTOTAL (YEAR 25)					**$2,500.00**	
Five-Year Review Report	20	1	LS	$2,500	$2,500.00	Preparation of one report at the end of Year 30.
SUBTOTAL (YEAR 30)					**$2,500.00**	

Table E-4. Alternative 3 - Cost Summary *(continued)*

Site: Mammoth Mine AOC

Description: Alternative 3 (Removal and Onsite Encapsulation [within the Altaville Mining District, near the AOC])
Cost Summary for the Mammoth Mine AOC EE/CA

Location: Six Rivers National Forest, Del Norte County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES[1]

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)[1]	PRESENT VALUE
Capital Cost	0	$ 761,500	$ 761,500	1.000	$ 761,500
Annual O&M Cost	1-30	$ 12,000.00	$ 400	0.757	$9,083.00
Periodic Cost	5	$ 2,500.00	$ 2,500	0.910	$ 2,275
Periodic Cost	10	$ 6,700.00	$ 6,700	0.828	$ 5,551
Periodic Cost	15	$ 2,500.00	$ 2,500	0.754	$ 1,885
Periodic Cost	20	$ 2,500.00	$ 2,500	0.686	$ 1,716
Periodic Cost	25	$ 2,500.00	$ 2,500	0.625	$ 1,562
Periodic Cost	30	$ 2,500.00	$ 2,500	0.569	$ 1,421
		$ 792,700.00			$ 785,000

TOTAL PRESENT VALUE OF SELECTED REMEDY **$785,000**

Notes:

(1) Based on a 1.9 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2013) at http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.

ARIC = Area Requiring Institutional Controls

BMPs = best management practices

cy = cubic yard

LS = lump sum

O&M = operation and maintenance

SF = square feet

Table E-5. Alternative 3 - Present Value Analysis

Year	Periodic Cost	Annual Cost	Discount Factor[1]	Actual Periodic Cost	Actual Annual Cost
1		$400	0.981354269		$392.54
2		$400	0.963056201		$385.22
3		$400	0.945099314		$378.04
4		$400	0.927477246		$370.99
5	$2,500	$400	0.910183755	$2,275.46	$364.07
6		$400	0.893212714		$357.29
7		$400	0.876558109		$350.62
8		$400	0.860214043		$344.09
9		$400	0.844174723		$337.67
10	$6,700	$400	0.828434468	$5,550.51	$331.37
11		$400	0.812987702		$325.20
12		$400	0.797828952		$319.13
13		$400	0.782952847		$313.18
14		$400	0.768354119		$307.34
15	$2,500	$400	0.754027595	$1,885.07	$301.61
16		$400	0.739968199		$295.99
17		$400	0.726170951		$290.47
18		$400	0.712630963		$285.05
19		$400	0.699343437		$279.74
20	$2,500	$400	0.686303668	$1,715.76	$274.52
21		$400	0.673507034		$269.40
22		$400	0.660949003		$264.38
23		$400	0.648625126		$259.45
24		$400	0.636531036		$254.61
25	$2,500	$400	0.624662449	$1,561.66	$249.86
26		$400	0.613015161		$245.21
27		$400	0.601585046		$240.63
28		$400	0.590368053		$236.15
29		$400	0.579360209		$231.74
30	$2,500	$400	0.568557614	$1,421.39	$227.42

Notes:

(1) Based on a 1.9 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2013) at http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.

Table E-6. Alternative 4 - Cost Summary

Site: Mammoth Mine AOC

Description: Alternative 4 (Removal and Offsite Disposal)
Cost Summary for the Mammoth Mine AOC EE/CA

Location: Six Rivers National Forest, Del Norte County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES[1]
Field Planning and Design Documents	1	LS	$39,500.00	$39,500	Includes three weeks for technical staff to complete a design and pre-mobilization plans (including Work Plan including a habitat and vegetation management plan and HASP with graphics, review, and production). Design costs include a site survey, one site visit for tech staff.
Mobilization and Demobilization	1	LS	$121,800.00	$121,800	Mobilization and demobilization of crew of 7 personnel, materials, and 6 pieces of equipment. Includes costs for sanitary facilities, and other project necessities. Includes per diem for all site workers. This task includes labor for project managment and invoicing.
Site Work					
Clear, Grub, and Road Repair	1.0	LS	$123,600.00	$123,600	Assumes the mine access road will require minor road repairs and minimal clearing of a path from the mine access road to waste pile 1 and 2 to allow for access of tracked equipment. Includes 4 pieces of equipment and a crew of 7 with per diem for all site workers. Assumes 10 days of work.
Excavate Source Materials	365	CY	$368.77	$134,600	Assumes approximately 365 cubic yards of soil from waste piles 1, 2, and 3 will be removed and transported to a staging area where it will be loaded into a long-haul dump truck for off site disposal. The staging area is approximately 1 mile from waste pile 1, 2, and 3. Includes 6 pieces of equipment and a crew of 7 with per diem for all site workers. Assumes 9 days of work.
Transportation and Disposal of Waste	1	LS	$153,500.00	$153,500	Assumes 365 cubic yards of non-RCRA California Hazardous waste waste will be off hauled. Includes 5 pieces of equipment and a crew of 7 with per diem for all site workers and a disposal contractor. Waste will be hauled to Dry Creek Landfill in Eagle Point, Oregon approximately 100 miles from the site. Assumes approximately 70 cubic yards of waste can be off hauled per day, 6 days of work.
Restoration	1.0	LS	$12,600.00	$12,600	Includes installation of erosion control measures (such as rolled erosion control mats and blankets, jute mesh, straw wattle) on disturbed areas. Assume 1 day to install.
After Action Report	1	LS	$9,800	$9,800.00	Includes 8 days for Technical Staff to write a completion report, including graphics, review, and production.
SUBTOTAL				**$595,400**	
Contingency	25%			$148,850.00	15% scope + 10% bid
SUBTOTAL				**$744,250**	
Project Management	10%			$59,540.00	Includes project management during all phases of construction, regulatory interface, permitting, and crew per diems.
Construction Management	12%			$71,448.00	Includes construction management, quality control, geotechnical testing, and quality control
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$875,200**	

Table E-6. Alternative 4 - Cost Summary *(continued)*

Site: Mammoth Mine AOC

Description: Alternative 4 (Removal and Offsite Disposal)
Cost Summary for the Mammoth Mine AOC EE/CA

Location: Six Rivers National Forest, Del Norte County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES[1]
Inspections and Maintenance					
Annual Inspections	1	LS	$ 300	$ 300	Annual inspection to be performed by Gasquet Forest Service Ranger to evaluate the integrity of all cover elements and storm water BMPs.
SUBTOTAL				**$300**	
Contingency	25%			$ 75	10% scope + 15% bid
		TOTAL ANNUAL O&M COSTS:		**$400**	per year
		TOTAL ANNUAL O&M COSTS:		**$2,000.00**	Years 1-5

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)[1]	PRESENT VALUE
Capital Cost	0	$ 875,200	$ 875,200	1.000	$ 875,200
Annual O&M Cost	1-5	$ 2,000	$ 400	0.763	$ 1,891
		$ 877,200			$ 877,100
TOTAL PRESENT VALUE OF SELECTED REMEDY				**$877,100**	

Notes:

(1) Based on a 1.9 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2013) at http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.

ARIC = Area Requiring Institutional Controls

BMPs = best management practices

cy = cubic yard

LS = lump sum

O&M = operation and maintenance

SF = square feet

Table E-7. Alternative 4 - Present Value Analysis

Year	Annual Cost	Discount Factor[1]	Actual Annual Cost
1	$400	0.981354269	$392.54
2	$400	0.963056201	$385.22
3	$400	0.945099314	$378.04
4	$400	0.927477246	$370.99
5	$400	0.910183755	$364.07
6	$0	0.893212714	$0.00
7	$0	0.876558109	$0.00
8	$0	0.860214043	$0.00
9	$0	0.844174723	$0.00
10	$0	0.828434468	$0.00
11	$0	0.812987702	$0.00
12	$0	0.797828952	$0.00
13	$0	0.782952847	$0.00
14	$0	0.768354119	$0.00
15	$0	0.754027595	$0.00
16	$0	0.739968199	$0.00
17	$0	0.726170951	$0.00
18	$0	0.712630963	$0.00
19	$0	0.699343437	$0.00
20	$0	0.686303668	$0.00
21	$0	0.673507034	$0.00
22	$0	0.660949003	$0.00
23	$0	0.648625126	$0.00
24	$0	0.636531036	$0.00
25	$0	0.624662449	$0.00
26	$0	0.613015161	$0.00
27	$0	0.601585046	$0.00
28	$0	0.590368053	$0.00
29	$0	0.579360209	$0.00
30	$0	0.568557614	$0.00

Notes:

(1) Based on a 1.9 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2013) at http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.

Attachment 1. Copper Creek 2012 Level II Stream Survey

COPPER CREEK

2012 LEVEL II STREAM SURVEY

Submitted to:

Six Rivers National Forest
Smith River National Recreation Area
Gasquet Ranger District
Gasquet, California

Prepared by:

W. Scott Bowman

September 2013

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Information Block

Stream Name:	Copper Creek
Tributary to:	Rowdy Creek / Smith River
Stream Order:	4
Mouth Location:	T18N, R01E, Sec. 16
Distance Surveyed:	3.30 miles
USGS Quadrangle:	High Divide
National Forest:	Six Rivers
Ranger District:	Gasquet
County, State:	Del Norte, California
NFS Watershed Code:	18, 01, 01, 01, 04, 03
Surveyors:	J. Deibner-Hanson, M. Larson, M. Parish, M. Reneski, M. McCain, W.S. Bowman

EXECUTIVE SUMMARY

INTRODUCTION

Copper Creek, a northwest flowing fourth order tributary to Rowdy Creek, is located in the Siskiyou Mountains and Coast Range of northern Del Norte County. Copper Creek drains a basin area of approximately 4,663 acres of moderately to steeply sloped terrain before joining Rowdy Creek approximately 7.4 miles upstream of the confluence of Rowdy Creek with Smith River. The Copper Creek watershed contains approximately 21 percent of the watershed area of Rowdy Creek. Copper Creek is located within an elevation range between 270 feet and 2,320 feet and it can receive in excess of 95 inches of precipitation a year. Most of this moisture is delivered to the watershed during the winter months often in high intensity – short duration rainstorms causing a runoff pattern that fluctuates in direct response to individual storms. Although none of the watershed is above 2,500 feet in elevation (the transient snow zone), snow accumulation in the upper watershed can occur in any given year. Rain-on-snow events, which are not uncommon in this watershed, can enhance the size of a flood. Peak and base flows (based on USGS flow data from the Rowdy Creek gage (period of record 1957-1962) and watershed area) suggest a flow range from an estimated 1,157cfs during large flow events to an estimated less than 1cfs during low flow or drought conditions. The actual peak flow of Copper Creek is most likely higher than the small USGS dataset above would suggest.

The majority of the Copper Creek watershed is located on public land managed by USFS Smith River National Recreation Area. The remaining two small segments, one located at the mouth and the other located in the upper watershed, are privately owned. Copper Creek is managed as a recreational stream. Past and present land uses within the watershed include road building, trail building, water diversion, mining, hunting, fishing, homesteading, timber harvest, botanizing, and back-country recreation. Previous surveys in the Copper Creek watershed have occurred in 1962, 1972, and 1974.

Upper Copper Creek is the site of the Union-Zarr Mine and the 2008 Union-Zaar Mine Rehab Project. The Union-Zaar Mine was originally called the Union Mine and was part of the “Low Divide” mining district, which included the Alta, Union, Crescent, Mammoth, and Star mines. The now-abandoned town of Altaville was also a part of the district. The Low Divide mining district was established in the 1860s as a copper mining district, and in later years chromium mines were also included in the district. The bulk of ore production at the Union-Zaar Mine occurred in the 1860s, which is when the adits and waste piles at the mine were built. The Union-Zaar Mine was one of the few sources of copper for the Union Army during the Civil War, and has had a few other short periods of activitiy around the early 1900s.

Investigations conducted at the Union Zaar Mine from 1991 to 2007 indicated the Union-Zaar Mine waste piles were a source of a variety of heavy metals contamination being released into Copper Creek. The summer/fall 2008 rehab project removed about 2,000 cubic yards of hazardous mine waste from 3 locations along the streambanks in the upper headwaters. As funding becomes available, additional rehab in the Copper Creek watershed will include removing more waste piles in the vicinity of the Union-Zaar Mine area.

From August 13, 2012 through August 16, 2012 approximately 3.30 miles of Copper Creek and were surveyed and typed for aquatic habitat, valley morphology, stream bank erosion, large woody material (LWM), dominant riparian vegetation, and fish abundance and distribution according to the protocol described in the 2012 version 2.12 Forest Service Region 6 Level II Stream Inventory Handbook. Funding for this survey was provided by a grant from the Del Norte Resource Advisory Committee via funds provided by the 2008-2011 Secure Rural Schools Public Law 110-343. Grant administration services were provided by Smith River Alliance. Additional support was provided by USFS Smith River National Recreation Area, Siskiyou Research Group, Smith River Advisory Committee, and Redwood National Park. This survey began at the mouth of Copper Creek in section 16 (High Divide quadrangle). Two reaches were delineated. Right and left stream bank designations are of the perspective of looking upstream. All slow water and fast water units were measured for length, width, and depth. **Table 1** summarizes the attributes of Copper Creek based on the data collected for this survey. The explanation of codes used in this report is found in **Appendix A**. The survey map showing the location of survey start and end points, tributaries, special case habitats, photographic points, and other noteworthy features is found in **Appendix B**. Photographs depicting representative habitats, unusual or permanent features, and survey start and end locations are found in **Appendix F**.

GEOLOGY / GEOMORPHOLOGY

The majority of the Copper Creek watershed is located in the geologically complex Klamath Mountain Province. Here the stream system flows through a portion of the Western Jurassic Belt, characterized as containing meta-sedimentary and meta-volcanic rocks as well as exposures of ultramafic rocks such as peridotite, gabbro, basalt, and serpentine of the Josephine peridotite body. Mineral and metal occurrences in the area include chalcopyrite, vanadium, mercury, copper, magnetite, chromite, cobaltite, cuprite, arsenic, antimony, gypsum, selenium, minerals associated with the 'Serpentine Group' and, to a lesser extent, gold, silver, and nickel-cobalt-chromium-magnesium laterite located along the ridges. Juxtaposed to the above in the very lower end of the stream system, Copper Creek enters the Coast Range Mountains and flows through exposures of the Cretaceous Franciscan Complex, characterized as containing sandstone, shale, conglomerate, chert, greenstone, and metagraywacke.

Copper Creek flows in a colluvial canyon ranging in shape from moderate V-shaped to narrow V-shaped. Sinuosity is moderate throughout the surveyed section. Stretches of sub-linear streamcourse are common. Terraces are uncommon. The canyon walls are moderately to steeply sloped. The steeper areas are sometimes associated with bedrock outcrop and occasionally associated with scattered bank instability. Despite the presence of bank instability, the canyon appeared stable. Channel gradient ranges from 5% in the lower watershed to 7% in the upper section.

Roads found in Copper Creek are limited to the upper watershed. Approximately 9.89 miles of road occur in the watershed. Just over half of these road miles are associated with access to mines or prospects found in the "Low Divide" mining district. A percentage of this road system was decommissioned as part of the 2008 Union-Zaar Mine Rehab Project. The remaining approximately 6.25 miles of road are all part of drainage divide following county route 305 (Wimer Road). Road density in the watershed is approximately 1.36 miles per square mile.

Table 1. Summary of Copper Creek Attributes

Reach	1	2	Reach	1	2
Stream Order	4	3	**Bank Instability (% reach length)**	1.9	2.8
Rosgen Channel Type	B2a	A2	**# Special Case Units**	0	2
Valley Segment Type	Colluvial Canyon	Colluvial Canyon	**Dominant / Subdominant Substrate**	Boulder / Cobble	Boulder / Cobble
Valley Form	Moderate V-shaped	Narrow V-shaped	**D_{50} - 1 (mm)**	150	359
Valley Width Estimate (ft)	80	60	**D_{84} - 1 (mm)**	403	882
Measured Length (miles)	1.88	1.43	**D_{50} - 2 (mm)**	202	195
Mapped Gradient (%)	5	7	**D_{84} - 2 (mm)**	605	607
Measured Sinuosity	1.21	1.22	**Dominant / Subdominant Riparian Veg. Class**	Shrub-seedl./ Small Tree	Shrub-seedl./ Sapling-pole
Entrenchment Ratio	1.39	1.4	**Overstory / Understory Riparian Species**	CD,HA,HB / HA,HR,SS	CD,CT,CQ / HA,CT,SS
Bankfull Width:Depth	34.50	23.47	**SWM / Mile**	25.5	20.3
Ave. Bankfull Width (ft)	34	22	**MWM / Mile**	3.2	4.9
Ave. Bankfull Depth (ft)	1.1	1	**LWM / Mile**	1.1	1.4
Ave. Floodprone Width (ft)	47	31	**Hi / Lo H_2O Temp. (^{0}C)**	16 / 13	20 / 16
Ave. Floodprone Depth (ft)	3.9	3.9	**Dominant Cover Type for Fish**	Substrate, Depth, Turbul.	Substrate, Turbulence
Ave. FW Width (ft)	16	12	**Fish Species Observed**	ONMY, ONCL, ONXX	ONMY, ONCL
Ave. FW Depth (ft)	0.8	0.5	**Salmonid Density (fish/yd^2)**	0.296	0.097
$SW_{(area)}$:$FW_{(area)}$	0.25	0.25			
SW Units / Mile	30.3	43.4			
Ave. Residual SW Depth (ft)	2.6	1.9			
% SW Units	20	19			

RIPARIAN

Riparian vegetation composition in Copper Creek is dependent on the underlying geology. In the lower portion of the steam, riparian vegetation was most often comprised of various quantities of

Douglas fir, tanoak, red alder, big-leaf maple, madrone, and myrtle in the small tree to large tree successional classes. Mature tree successional class vegetation was rarely observed but when it was it was in the form of scattered coast redwood situated outside of the riparian zone. The understory in this area was most often comprised of shrub-seedling successional class to small tree successional class red alder, big-leaf maple, myrtle, and various shrubs. Riparian provided stream shade in this area was often quite good. The majority of riparian vegetation encountered was consistent with species found in ultramafic and serpentine environments. Douglas fir, Port Orford cedar, western white pine, knobcone pine, and western red cedar were observed in the sapling-pole successional class to small tree successional class sizes as part of the upper canopy in this area. The riparian understory was usually comprised of red alder, madrone, and various shrubs in the shrub-seedling to small tree successional classes. Areas of no vegetation (typically bedrock outcrop, in old areas of mining , or bank instability) were observed. The density of riparian vegetation in the ultramafic / serpentine environment ranged from moderate to sparse. Generally, solar influence to the stream increased in an upstream direction. Large woody material recruitment potential was considered poor throughout the surveyed section.

AQUATIC

The aquatic habitat was dominated by fast water. However, observations during field inspections and data analysis suggest as much as 84% of the non-turbulent riffles tallied (those with a maximum depth $\geq$ 1.5 feet) could have been considered shallow pools. Most fast water units contained at least some pocket pool habitat. Pools were often relatively small in area and often moderately shallow. Only twenty-four of the 119 pools tallied had a residual depth greater than three feet. Boulder was the dominant substrate type. Boulder appeared to be the primary agent in pool formation. Gravel was present either as interstitial fill between larger substrate, in eddy deposits, in occasional small patches in pooltails, and along stream margins. Bedrock outcrop was observed throughout the surveyed section. Occasionally, especially in the upper portion of the surveyed section, bedrock appeared to contribute to pool formation and maintenance. Sand was a minor substrate component. Most of the sand observed was located in reach 1. The substrate did not appear embedded. The two side channels tallied appeared to offer little in terms of refuge opportunities for fish that differed from the fast water main channel. Three barriers to fish migration, a bedrock created waterfall, a bedrock and boulder created chute, and an instance of dry channel, were tallied. All of these were located in reach 2. Three other features (steep plunges at the base of fast water units into pools) were thought to be possible barriers to fish migration. These were located upstream of tributary #2 in reach 1. With few exceptions, large woody material appeared to have little influence on habitat complexity in Copper Creek. What influence this material had on stream morphology was largely contained in reach 1.

FISHERIES

Copper Creek contained rainbow/steelhead trout, cutthroat trout, and two unknown salmonids as determined during snorkel surveys. Average fish density was moderately low (0.197 fish/yd^2). Eighty-seven percent of the fish observed were tallied in reach 1. Cover for fish was provided by substrate, turbulence, depth, sporadic overhanging vegetation, and, to a much lesser extent, LWM. Some evidence of anadromy was noted in lower reach 1. The probable anadromous limit in Copper was considered to be located approximately 2.41 miles upstream of the mouth at the beginning of a steeper rapid / cascade sequence found just downstream of waterfall #1 in reach 2. The last fish observed was found in a mid-channel pool situated just upstream of the bedrock chute in reach 2 near the survey endpoint. Suitable spawning habitat appeared to be the primary factor limiting anadromous use of Copper Creek. Water clarity appeared good. Water temperature ranged from 13^0 C to 20^0 C, below lethal levels for fish. The warmest water was encountered in the sparsely vegetated upper portion of reach 2.

Table 2 provides a concise summary description of measured habitat parameters and qualitative observations. The environmental baseline column is included as a qualitative assessment of habitat and watershed conditions at the time of this survey.

Table 2. Summary of Copper Creek Baseline Conditions

SUMMARY of SURVEYED HABITAT PARAMETERS	ENVIRONMENTAL BASELINE		
	Properly Functioning	At Risk	Not Properly Functioning
WATER QUALITY Temperature range is 13C to 20C, below lethal levels for fish. Riparian provided shade is dependent on geology. Shade is more common in metasedimentary areas - less common in peridotite/serpentine dominated areas. No suspended sediment detected. Negligible turbidity. Water is clear.			
HABITAT ACCESS Steeper rapids and cascades, a waterfall, chute, and an area of dry channel combined with diminishing streamflow in reach 2 create natural limits to fish distribution.			
HABITAT ELEMENTS Fast water dominated expressed mainly as rapids. Boulder/cobble dominated substrate. Gravel is found more often as interstitial fill rather than in patches suitable for spawning. The streambed is not embedded. Large woody material density is naturally low. The riparian zone appears largely intact and unmanaged. Pool density is moderately low. Pools formed primarily by boulder and occasionally by bedrock. Average pool depth is 2.3 feet. Side channels offer little in terms of habitat that differs from the main channel. Anadromy likely extends 2.41 miles up from mouth.			
CHANNEL CONDITION Stable. Evidence of active bank instability observed. Channel does not appear to be aggraded.			
HYDROLOGY Measured discharge within expected range. Stream is fed by numerous tributaries, seeps, and springs.			
Historic heavy metal contamination into the stream continues.			
WATERSHED CONDITIONS Road density is approximately 1.36 miles per square mile. Most roads are high in subwatersheds or along drainage divides.			
Affects of past mining activities, both aqueous heavy metal contamination and erosion of toxic main waste into the stream are ongoing.			

REACH SUMMARIES

REACH 1

Reach 1 began at the confluence with Rowdy Creek and ended 1.88 miles upstream at the mouth of tributary #4 in section 22 (High Divide, Calif.-Oreg. quadrangle). Reach 1 ended at this location due to a reduction of streamflow, a valley form change, and a Rosgen stream type change.

GEOMORPHOLOGY / HYDROLOGY

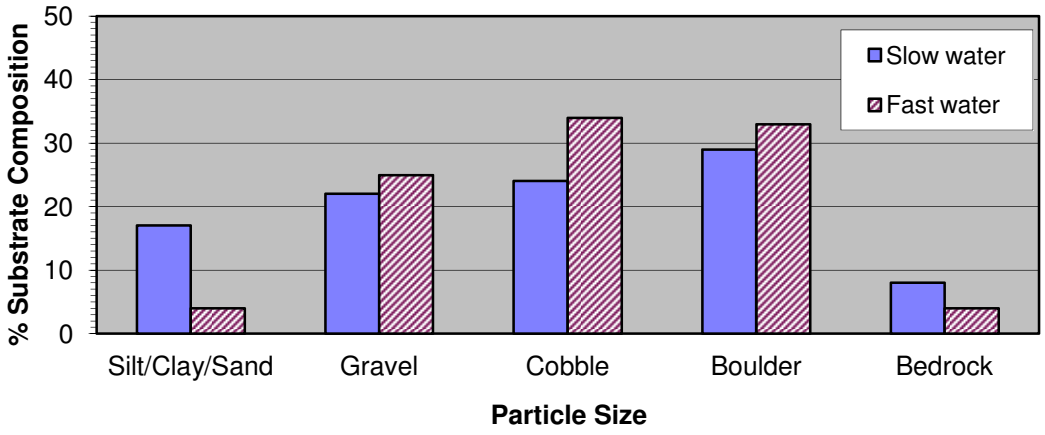
Reach 1 is in a somewhat incised channel contained within a moderate V-shaped colluvial canyon. Terraces or elevated floodplains were uncommon. A moderately narrow valley width (estimated to be 80 feet), moderate to high side slope gradient, moderate stream gradient (5%), and a moderately entrenched channel characterize this valley segment (photos 3, 6, 10, 12, and 16). Measured sinuosity was moderately low at 1.21. Sections of sub-linear streamcourse (photos 3, 12, and 16) were observed.

Channel substrate composition estimates were made at every slow water and fast water habitat in order to describe the streambed for each habitat. These estimates were then averaged for the reach. The result depicts a channel slightly dominated by boulder (**Figure 1**). Cobble estimates in slow water were slightly lower than boulder but slightly higher than boulder in fast water. Gravel comprised the interstitial fill between the cobble and boulder and was noted in eddy deposits, in patches in pooltails, and along stream margins. A low percentage of bedrock outcrop was common throughout the reach and was most often found along habitat margins. No channel units were considered bedrock created. However, in a few units, bedrock appeared to be a contributor to habitat maintenance (photos 12 and 15). Sand was noted as a minor though somewhat persistent substrate component. Seventy-nine of the 151 main channel units tallied in reach 1 contained quantifiable amounts of sand. Most of the sand encountered was found in pools. Despite the presence of sand, the substrate of reach 1 did not appear embedded. Ten cross section measurements were conducted in reach 1. The results were averaged to describe a moderately entrenched channel with an entrenchment ratio of 1.39 and a bankfull width to depth ratio of 34.50. The average median particle size calculated from two Wolman pebble counts gave a median channel substrate size (D_{50}) of 176mm (Wolman pebble count graphs are found in **Appendix C**). Based on an average of cross section data, Wolman pebble counts, substrate estimates, measured stream gradient, and qualitative interpretation, Rosgen (1996) stream type B2A best describes reach 1 of Copper Creek.

All instances of bank instability were measured for length to determine the percent of reach length affected by eroding banks. Six instances of bank instability were noted in reach 1 totaling 185 feet in length (1.9% of reach length). Small landslides scattered throughout the reach were the type of

bank instability observed. Despite the presence of these features, the canyon of reach 1 appeared stable. A discharge measurement of 2.86cfs was collected near the mouth at SO 4 using a calibrated Marsh-McBirney meter. Four tributaries entered reach 1 (**Table 3**). Three were considered significant flow contributors and one, tributary #4 (photo 18), was considered potentially fish-bearing.

Figure 1. Average Substrate Composition
Copper Creek Reach 1



RIPARIAN

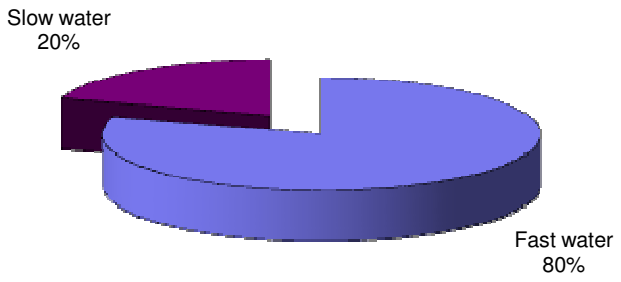
Riparian vegetation in reach 1, as determined at each measured habitat, consisted of an upper canopy dominated by small tree successional class to large tree successional class Douglas fir, Big-leaf maple, red alder, and myrtle. The lower canopy consisted of a mix of shrub-seedling successional class to small tree successional class red alder, big-leaf maple, willow, myrtle, and various shrubs. Occasionally, in the lower portion of the reach, coast redwood was observed residing outside the riparian zone. No live trees were noted engaging the bankfull plane. Areas with little or no vegetation were not observed. Generally, the riparian zone appeared well populated but hardwood dominated. Occasionally, vegetation of the lower canopy encroached the channel (photos 9, 10, and 13). In a few instances riparian vegetation provided near complete canopy closure over the stream (photos 3, 5, and 13). Overall, riparian vegetation combined with canyon aspect and time of day appeared to offer good stream shade. Given the size and proximity to the stream of the larger conifers observed, large woody material (LWM) recruitment potential appeared poor.

AQUATIC

The aquatic habitat of reach 1 was dominated by riffles and rapids photos 3, 5, 15, 16, and 17). Mid-channel pools, lateral scour pools, plunge pools, as well as a debris dam pool and a landslide dam pool (photos 4, 6, 10, and 12) comprised the slow water habitat in reach 1. Cover for fish was provided by depth, turbulence, substrate, sporadic overhanging vegetation, and, to a much

lesser extent, LWM. One side channel was tallied in reach 1. This feature was considered fast water dominated. This side channel appeared to offer little in terms of refuge opportunities for fish that differed from the adjacent fast water main channel. Several dry side channels were noted. No special case units were tallied in reach 1. **Figure 2** provides a generalized breakdown of the aquatic habitat composition (based on data collected) in reach 1 of Copper Creek.

Figure 2. Habitat Composition
Copper Creek Reach 1

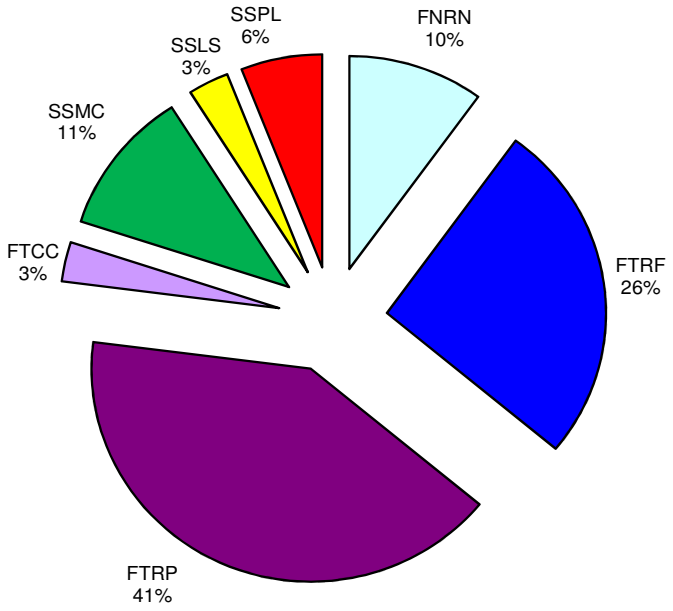


Fifty-seven slow water units were tallied giving reach 1 a pool frequency of 30.3 pools/mile. Four pools exceeded 4 feet in residual depth. Seventeen pools exceeded three feet in residual depth. Forty-two pools had a residual depth greater than 2 feet. Average residual pool depth was 2.6 feet. The deepest pool (4.7 feet residual depth) was a plunge pool (photo 10) bracketed by two short cascades. Generally, pools were small in area, relatively shallow, separated by occasional long stretches of fast water, and hydraulically controlled by boulder.

Ninety-four fast water units tallied comprised 80% of the total habitat area of reach 1. However, observations during field inspections and data analysis suggest as much as 92% of the deeper (maximum depth $\geq$ 1.5 feet) non-turbulent riffles tallied (24 of 26) could have been classified as relatively shallow pools, possibly a more accurate representation of the amount of slow water habitat found in reach 1. One fast water unit was greater than 300 feet in length. Ten were over 200 feet long. Comprised mainly of rapids, the fast water units of reach 1 are best described as sometimes long and rather deep (83 feet average length, 0.8 feet average depth) units offering a moderate amount of habitat complexity for fish. Most fast water units contained at least some pocket pool habitat. Average fast water width was 16 feet, average bankfull depth was 1.1 feet, and the average floodprone depth was 3.9 feet.

A further breakdown of habitat composition in terms of habitat area (based on data collected) reveals rapids as the most dominant habitat type followed distantly by riffles (**Figure 3**). An explanation of codes used in this figure can be found in **Appendix A**.

Figure 3. Copper Creek Channel Unit Composition
Reach 1



At a density of 29.8 pieces/mile, LWM was moderately sparse in reach 1 of Copper Creek (**Figure 4**). Eighty-six percent of the LWM tallied was in the small class category. Only two large class pieces of LWM were tallied. Most LWM was found as scattered pieces. A few were located in small debris jams (photo 9). Few appeared to have any appreciable influence (photo 13) on habitat complexity. Most pieces appeared old. A few bankfull adjacent pieces as well as a few small debris jams residing atop small terraces were noted. No wood habitat enhancement structures were found. Three spanners (logs spanning the channel that would be considered to represent future LWM) were observed in the reach.

Figure 4. Large Woody Material
Copper Creek

FISHERIES

Fish identification and enumeration were obtained from snorkel surveys. The sampling frequency, based on a random start, was every fifth slow water unit and every tenth fast water unit. Eleven slow water units and eleven fast water units were snorkeled in reach 1. Steelhead/rainbow trout and cutthroat trout as well as 2 size class 2 unknown salmonids were the fish tallied during this survey. Combining age classes, 675 steelhead/rainbow trout (0.293 fish/yd^2), 6 cutthroat trout (0.003 fish/yd^2), and 2 unknown salmonids (0.001 fish/yd^2) were counted for an overall reach salmonid density of 0.296 fish/yd^2. Based on the data collected, most fish (56%) were observed in fast water units. Of the 683 salmonids tallied, 610 (89.3%) were in size class 1, 62 (9.1%) were size class 2, and 11 (1.6%) were size class 3. Qualitatively, it appeared fast water contained the best spawning habitat. Suitable spawning habitat appeared to be the primary factor limiting anadromous use of reach 1.

Water clarity appeared good. Water temperature was cool ranging from 13^{0}C to 16^{0}C, well below lethal levels for fish. Other aquatic dependent species noted included crayfish and Pacific giant salamanders. **Table 4** summarizes the results of the snorkel survey data collected for species, habitat type, and size class. **Appendix D** contains habitat dimensions and fish counts in a calculation table used to derive fish densities.

Table 3. Summary of Tributary Information Collected for Copper Creek

Tributary Number	Reach #	Est. Flow Contrib.	Fish Bearing?	Temp (^{0}C)	Time	Gradient at Mouth	Enters From	Tributary Name
1	1	2%	?	13	1459	38%	Left	None
2	1	15%	?	14	1008	25%	Left	None
3	1	10%	?	14	1228	9%	Right	None
4	1	20%	Yes?	15	1255	5%	Left	None
5	2	10%	?	14	1450	24%	Right	None
6	2	50%	?	14	1309	200%	Right	None
7	2	40%	No	19	1510	34%	Left	None

REACH 2

Reach 2 began at the mouth of tributary #4 and ended 1.43 miles upstream at the mouth of tributary #7 in section 26 (High Divide, Calif.-Oreg. quadrangle). Reach 2 ended at this location due to the lack of fish and the presence of a repeatable reach end location.

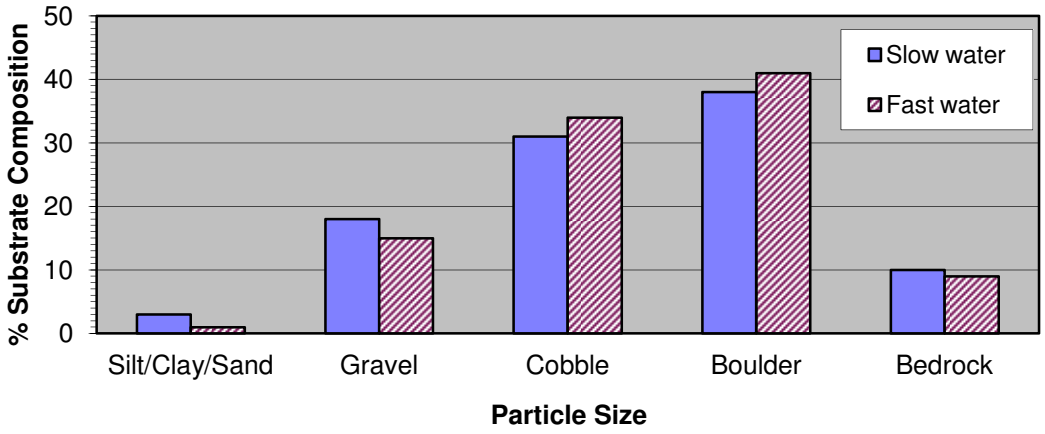
GEOMORPHOLOGY / HYDROLOGY

Reach 2 is in a somewhat incised channel contained within a narrow v-shaped alluvial canyon. Terraces or elevated floodplains were uncommon. A narrow valley width (estimated to average 60 feet), moderate to high side slope gradient, moderately high stream gradient (7%), and a moderately entrenched channel characterize this valley segment (photos 19, 22, 23, 29, and 31). Measured sinuosity was moderately low at 1.22. Sections of sub-linear streamcourse (photos 19 and 23) were observed.

Channel substrate composition estimates made at every slow water and fast water habitat depict a somewhat boulder dominated channel (**Figure 5**). Gravel comprised the interstitial fill between the cobble and boulder and was noted in eddy deposits, in small patches in pooltails, and along stream margins both inside and outside of the wetted channel. Cobble was more common in fast water than in slow water. Boulder appeared to be the main element shaping habitat complexity. Bedrock outcrop was more common than downstream and was occasionally the dominant substrate component. The presence of sand was noticeably less than in reach 1. Only twenty-three of the 145 main channel units tallied in reach 2 contained quantifiable amounts of sand. The substrate of reach 2 did not appear embedded. Seven cross section measurements were conducted in reach 2. The results describe a moderately entrenched channel with an entrenchment ratio of 1.40 and a bankfull width to depth ratio of 23.47. The median particle size calculated for two Wolman pebble counts gave a median channel substrate size (D_{50}) of 277mm (Wolman pebble count graphs are found in **Appendix C**). This figure indicates a rather substantial increase in substrate size compared to reach 1. Based on an average of cross section

data, Wolman pebble counts, substrate estimates, measured stream gradient, and qualitative interpretation, Rosgen (1996) stream type A2 best describes reach 2 of Copper Creek.

Figure 5. Average Substrate Composition
Copper Creek Reach 2



Seven instances of bank instability were noted in reach 2 totaling 213 feet in length (2.8% of reach length). Landslides (photo 24) were the type of bank instability observed. Most of the landslides encountered were small in area. Three tributaries entered Copper Creek in reach 2 (**Table 3**). All were significant contributors to streamflow (photo 28) but none were considered fish-bearing.

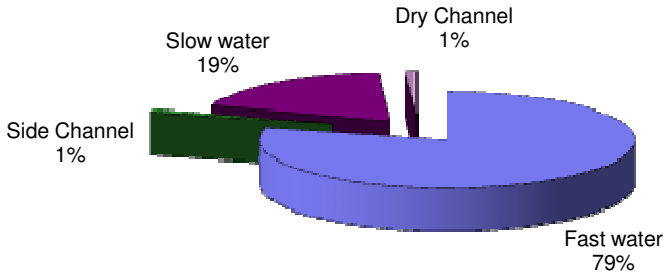
RIPARIAN

The riparian vegetation in reach 2 was dominated by shrub-seedling successional class to small tree successional class Douglas-fir, Port Orford cedar, western white pine, and occasionally knobcone pine. The lower canopy consisted of a mix of shrub-seedling successional class to small tree successional class red alder, big-leaf maple, willow, madrone, myrtle, and various shrubs. The few large tree successional class trees observed, namely Douglas fir, Port Orford Cedar, and big-leaf maple, were found in the lower third of the reach. Areas with little to no vegetation were observed primarily in the upper portion of the reach in the areas of bank instability, bedrock outcrop, and old mining roads. No trees were noted engaging the bankfull plane. Generally, the density and stream shade providing influence of riparian vegetation decreased in an upstream direction (photos 19, 21, 23, 26, and 31). In reach 2, canyon aspect and time of day appeared to offer the best opportunity for stream shade. Given the size and proximity to the stream of the larger conifers observed, large woody material (LWM) recruitment potential was considered poor.

AQUATIC

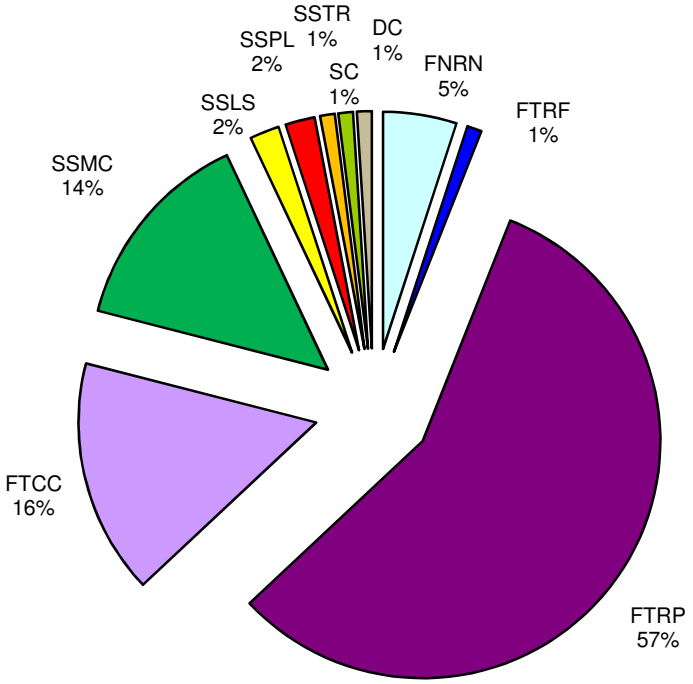
The aquatic habitat of reach 2 was dominated by rapids and cascades (photos 19, 22, and 23). Mid-channel pools, plunge pools, lateral scour pools, and one each of a convergence pool, trench pool, and debris dam pool (photos 21, 25, 26, and 30) comprised the slow water habitat. Cover for fish was provided by substrate, turbulence, and to a much lesser extent, LWM. The lone side channel encountered in reach 2 was long (225 feet) and considered fast water dominated. This channel carried an estimated 45% of the flow of Copper Creek in this area. It appeared this feature may offer some refugia for fish that differed from the main channel. A few dry side channels were noted in the upper portion of the reach. Two special case units were observed in reach 2. The first was a bedrock created waterfall 4 feet high with a gradient of 82%. The second was a bedrock and boulder created chute (photo 29). Both features were considered fish migration barriers. Though not a special case unit, a short (53 feet) section of dry channel was also considered a barrier to fish migration during low flow conditions. **Figure 6** provides a generalized breakdown of the aquatic habitat composition (based on data collected) in reach 2 of Copper Creek.

Figure 6. Habitat Composition
Copper Creek Reach 2



A further breakdown of habitat composition in terms of habitat area (based on data collected) reveals rapids as the most dominant habitat type followed by cascades (**Figure 7**). An explanation of codes used in this figure can be found in **Appendix A**.

Figure 7. Copper Creek Channel Unit Composition
Reach 2



Sixty-two slow water units were tallied giving reach 2 a pool frequency of 43.4 pools/mile. One pool exceeded 5 feet in residual depth. Only two pools exceeded 4 feet in residual depth. Seven pools had a residual depth greater than 3 feet. Average residual pool depth was 1.9 feet. The deepest pool (5.7 feet residual depth) was a plunge pool located immediately downstream of waterfall #1. Generally, pools were more abundant but much smaller in area than those in reach 1, rarely deep, and hydraulically controlled by large substrate or bedrock. Residual pool depth appeared to decrease in an upstream direction.

Eighty fast water units comprised 79% of total habitat area of reach 2. However, observations during field inspections and data analysis suggest as much as 67% of the deeper (maximum depth $\geq$ 1.5 feet) non-turbulent riffles tallied (8 of 12) could have been classified as relatively shallow pools, possibly a more accurate representation of the amount of slow water habitat found in reach 2. Comprised mainly of rapids, the fast water units of reach 2 are best described as relatively long (74 feet average length) yet somewhat shallow (0.5 feet average depth) units offering a limited amount of habitat complexity for fish. The fast water units of reach 2 were considered to contain at least a minor amount of pocket pool habitat. Streamflow through many of the fast water units appeared sieve-like. Average fast water width was 12 feet, average bankfull

depth was 1 foot, and average floodprone depth was 3.9 feet. Of note is the identical average floodprone depths between reaches 1 and 2.

At a density of 26.6 pieces/mile, LWM was moderately sparse reach 2 of Copper Creek (**Figure 4**). LWM appeared to offer little in terms of habitat complexity. Few pieces (photos 20, 21, and 22) appeared to have any appreciable influence on channel morphology. Most of the LWM encountered was located in the lower portion of the reach. Of the 38 pieces of LWM tallied, 29 (76%) were in the small class category, 7 (19%) were in the medium class category, and 2 (5%) were in the large class category. Almost all pieces appeared old. Most pieces of LWM were found as scattered pieces. A couple of logjams (i.e. photo 22) contained many pieces of wood too small to qualify as LWM. One piece of LWM was noted as residing adjacent to bankfull. Many pieces too small to count as LWM were observed. Eighteen spanners (logs or live trees spanning the channel that would be considered to represent future LWM) was observed in the reach. No habitat enhancement structures were observed.

Table 4. Summary of Fish Species, Size Class, and Density by Habitat Type in Copper Creek

Reach	Habitat	% Area	Species	Tally by Size Class			Total Salmonids			Salmonid Density (fish/yd^2)								
#	Type	Sampled	Code	1	2	≥3	SW	FW	Sum	SW	FW	ONMY	ONCL	ONXX	ONTS	1	≥2	Total
1	SW		ONMY	241	38	9												
		12.9	ONCL	0	1	1												
	FW		ONMY	369	17	1												
			ONCL	0	4	0												
		10.6	ONXX	0	2	0												
	Salmonid Size Class Totals			610	62	11	290	393	683	0.533	0.223	0.293	0.003	0.001	0	0.265	0.032	0.296
2	SW		ONMY	44	14	2												
		20	ONCL	2	0	1												
	FW		ONMY	27	5	0												
		7	ONCL	1	3	0												
	Salmonid Size Class Totals			74	22	3	63	36	99	0.149	0.060	0.090	0.007	0	0	0.072	0.024	0.097

Size Class Definition: 1 = 0 to 100mm, 2 = 100mm to 200mm, ≥3 = >200mm

FISHERIES

Thirteen slow water units and eight fast water units were snorkeled in reach 2. Steelhead/rainbow trout and cutthroat trout were the fish species identified during this survey. Combining age classes, 92 steelhead/rainbow trout (0.090 fish/yd^2) and 7 cutthroat trout (0.007 fish/yd^2) were counted for a reach salmonid density of 0.097 fish/yd^2. This is a substantially lower salmonid density than what was encountered in reach 1. Most fish (64%) were observed in fast water units. The majority of this fish population was steelhead/rainbow trout in size class 1. Of the 99 salmonids tallied, 74 (75%) were in size class 1, 22 (22%) were in size class 2, and 3 (3%) were in size class 3. Although no evidence of anadromy was noted, anadromous fish use of reach 2

(based on the quantity of fish observed) does occur in the lower portion of the reach. Based on a marked decrease in fish quantity, the probable anadromous limit in Copper Creek was thought to be located approximately 0.53 miles upstream of tributary #4 at the beginning of a steeper rapid / cascade sequence found just downstream of waterfall #1. The last fish observed (size class 2 ONMY) was found in a small mid-channel pool (SO 296, photo 30) located approximately 546 feet downstream of the end of the reach. As in reach 1, the amount of suitable spawning habitat appeared to be the primary factor limiting anadromous use of lower reach 2 of Copper Creek.

Water clarity appeared good. Water temperature ranged from 16^0C to 20^0C, below lethal levels for fish. Other aquatic dependent species noted included a crayfish, a yellow-legged frog, and Pacific giant salamanders. **Table 4** summarizes the results of the snorkel survey data for species, habitat type, and size class. **Appendix E** contains habitat dimensions and fish counts in a calculation table used to derive fish densities.

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Attachment 2. Riparian Management Standards and Statutes for Copper Creek CERCLA Mine Tailing Abatement

Riparian Management standards and statutes for Copper Creek CERCLA mine tailing abatement

Management Direction from Six Rivers LRMP and Smith River NRA Act provisions

LMP S&Gs for Minerals Management (LRMP IV-47-48)

MM-1. Require a reclamation plan, approved Plan of Operations, and reclamation bond for all minerals operations that include Riparian Reserves. Such plans and bonds must address the costs of removing facilities, equipment, and materials; recontouring disturbed areas to near pre-mining topography; isolating and neutralizing or removing toxic or potentially toxic materials; salvage and replacement of topsoil; and seedbed preparation and revegetation to meet Aquatic Conservation Strategy objectives.

MM-2. Locate structures, support facilities, and roads outside Riparian Reserves. Where no alternative to siting facilities in Riparian Reserves exists, locate them in a way compatible with Aquatic Conservation Strategy objectives. Road construction will be kept to the minimum necessary for the approved mineral activity. Such roads will be constructed and maintained to meet roads management standards and to minimize damage to resources in the Riparian Reserve. When a road is no longer required for mineral or land management activities, it will be closed, obliterated, and stabilized.

MM-3. Prohibit solid and sanitary waste facilities in Riparian Reserves. If no alternative to locating mine waste (waste rock, spent ore, tailings) facilities in Riparian Reserves exists, and releases can be prevented, and stability can be ensured, then:

a. analyze the waste material using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics.

b. locate and design the waste facilities using best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. If the best conventional technology is not sufficient to prevent such releases and ensure stability over the long term, prohibit such facilities in Riparian Reserves.

c. monitor waste and waste facilities after operations to ensure chemical and physical stability and to meet Aquatic Conservation Strategy objectives.

d. reclaim waste facilities after operations to ensure chemical and physical stability and to meet Aquatic Conservation Strategy objectives.

e. require reclamation bonds adequate to ensure long-term chemical and physical stability of mine waste facilities.

MM-4. For leasable minerals, prohibit surface occupancy within Riparian Reserves for oil, gas, and geothermal exploration and development activities where leases do not already exist. Where possible, adjust the operating plans of existing contracts to eliminate impacts that retard or prevent the attainment of Aquatic Conservation Strategy objectives.

MM-5. Salable mineral activities such as sand and gravel mining and extraction within Riparian Reserves will occur only if Aquatic Conservation Strategy objectives can be met.

MM-6. Include inspection and monitoring requirements in mineral plans, leases or permits. Evaluate the results of inspection and monitoring to effect the modification of mineral plans, leases and permits as needed to eliminate impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.

LRMP S&Gs for Watershed and Habitat Restoration

WR-1. Design and implement watershed restoration projects in a manner that promotes long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and attains Aquatic Conservation Strategy objectives.

WR-2. Cooperate with federal, state, local, and tribal agencies, and private landowners to develop watershed-based Coordinated Resource Management Plans or other cooperative agreements to meet Aquatic Conservation Strategy objectives.

WR-3. Do not use mitigation or planned restoration as a substitute for preventing habitat degradation.

The Smith River NRA Act (1990) designated Rowdy Creek (including Copper Cr – a tributary to Rowdy Cr.) as part of the Smith River Wild And Scenic System.

SEC. 10. WILD AND SCENIC RIVERS.
(a) PREVIOUS DESIGNATIONS- Previous designations dated January 19, 1990, by the Secretary of the Interior (46 Fed. Reg. 7483-84) under section 2(a)(ii) of the Wild and Scenic Rivers Act (16 U.S.C. 1273) of rivers within the exterior boundary of the recreation area are superseded by this Act.
(b) DESIGNATIONS- Section 3(a) of the Wild and Scenic Rivers Act (16 U.S.C. 1274) is amended by adding at the end thereof the following new paragraphs:
`( ) SMITH RIVER, CALIFORNIA- The segment from the confluence of the Middle Fork Smith River and the North Fork Smith River to the Six Rivers National Forest boundary, including the following segments of the mainstem and certain tributaries, to be administered by the Secretary of Agriculture in the following classes:
`(A) The segment from the confluence of the Middle Fork Smith River and the South Fork Smith River to the National Forest boundary, as a recreational river.
`(B) Rowdy Creek from the California-Oregon State line to the National Forest boundary, as a recreational river.

Recreational River S&Gs (LRMP IV-60) for Minerals include:

> Mineral activity will be conducted in a manner that minimizes surface disturbance, sedimentation, pollution, and visual impairment.

LMP Aquatic Conservation Strategy (ACS) Objectives 3, 4, and 5 relate to the mine waste deposits along Copper Creek (LRMP IV-108). These 3 Objectives

address bank and channel integrity, water quality, and sedimentation – which all relate to the impacts from the tailings sites.

ACS Objective 3.

Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

ACS Objective 4.

Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

ACS Objective 5.

Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

References

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Smith River National Recreation Area Act. 1990. Public Law PL-101-612.