ENGINEERING EVALUATION/COST ANALYSIS

Eureka Smelter Site, Town of Eureka
Eureka, Eureka County, Nevada

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U.S. Environmental Protection Agency
Region 9

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LIST OF ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
µg/dL	micrograms per deciliter
$\mu g/ft^2$	micrograms per square foot
µg/L	micrograms per liter
AOC	area(s) of concern
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	contaminant of potential concern
CSM	Conceptual Site Model
CWA	Clean Water Act
CY	cubic yard
DOI	U.S. Department of Interior
E & E	Ecology and Environment, Inc.
ECS	Eureka Consolidated Smelter
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESSL	Elevated Site Screening Level
ET	evapotranspiration
H:V	horizontal to vertical slope ratio
Handbook	Superfund Lead-Contaminated Residential Sites Handbook, EPA 2003
HAZWOPER	Hazardous Waste Operations per 40 CFR 1910.120
HDPE	high density polyethylene
HI	Hazard Index
ICP	Institutional Control Plan
ICs	Institutional Controls
INAA	Instrumental Neutron Activation Analysis
IVBA	*in vitro* bioaccessibility
km	kilometer
LBP	lead-based paint
LDR	Land Disposal Restriction
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MWMP	Meteoric Water Mobility Procedure
NAC	Nevada Administrative Code
NCP	National Contingency Plan
ND	Not detected
NDEP	Nevada Division of Environmental Protection
NPDES	National Pollutant Discharge Elimination System

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

NPDWRs	National Primary Drinking Water Regulations
NPL	National Priority List
NPV	net present value
NRS	Nevada Revised Statutes
NSDWRs	National Secondary Drinking Water Regulations
NYDEC	New York Department of Environmental Conservation
O&M	operations and maintenance
ORD	Office of Research and Development
OSHA	Occupational Health and Safety Administration
OU	Operable Unit
PPE	personal protective equipment
ppm	parts per million
QC	quality control
R^2	coefficient of determination
RAO	Removal Action Objective
RBA	relative bioaccessibility
RCRA	Resource Conservation and Recovery Act
RCS	Richmond Company Smelter
RSL	Regional Screening Level
SPLP	synthetic precipitation leaching procedure
sq. ft.	square feet
SRA	Streamlined Risk Assessment
SSL	Site Screening Level
START	Superfund Technical Assessment and Response Team
STLC	soluble threshold limit concentration
SWPPP	Storm Water Pollutant Prevention Plan
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
TCRA	Time Critical Removal Action(s)
TTLC	total threshold limit concentration
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
XRF	X-ray fluorescence

1. INTRODUCTION

This Engineering Evaluation and Cost Analysis (EE/CA) for a planned non-time-critical Removal Action to address lead and arsenic contamination present in the Town of Eureka Site (Eureka Smelter Site, or the “Site”), Eureka County, Nevada was prepared by U.S. Environmental Protection Agency (EPA) staff and Weston Solutions, Inc. (WESTON®).

The Town of Eureka (the Town) is an unincorporated community located in Eureka County, Nevada. Eureka is situated in a historical mining district with at least seven known former ore milling and smelter operations located throughout the Town. As a result of these historic milling and smelting operations, widespread lead and arsenic contamination exists throughout much of the Town.

This EE/CA has been prepared in accordance with the EPA’s Guidance on Non-Time Critical Removal Action (EPA, 1993). This EE/CA identifies and evaluates a range of cleanup alternatives and recommends the preferred cleanup alternative, hereafter referred to as “cleanup action” for the Site. Also, because of widespread lead contamination in Eureka, EPA guidance Superfund Lead-Contaminated Residential Sites Handbook (EPA, 2003; [Handbook]) was considered throughout the development of this document.

2. SITE DESCRIPTION AND BACKGROUND

2.1 SITE LOCATION

The Town of Eureka is an unincorporated community located in Eureka County, Nevada. Eureka is located in east-central Nevada, approximately 243 miles from Reno, 318 miles from Salt Lake City, and 323 miles from Las Vegas. Eureka occupies approximately 480 acres of land in the southern part of Eureka County, at an elevation of approximately 6,900 feet above sea level. The geographical coordinates for the approximate center of Eureka are 39° 30′ 45″ Latitude North and 115° 57′ 39″ Longitude West. A regional site location map is provided as Figure 1. As shown in Figure 1, the Town of Eureka is surrounded by land administered by the Bureau of Land Management (BLM).

Eureka is bisected by U.S. Highway 50 and a narrow, ephemeral (intermittent) creek, herein after referred to as Eureka Creek, which run parallel to each other on a north-south axis through the Town. The area directly to the north is hilly terrain that opens into a broad alluvial plain. The creek flows from south to north through the Town and into the alluvial plain. The residential, commercial and public properties in Eureka are primarily situated in the hills along the east and west sides of U.S. Highway 50.

2.2 SITE HISTORY

2.2.1 Mining History

The discovery of mineral deposits in Eureka dates back to 1864. Numerous historical references document the development of the mining industry in Eureka. The following information regarding the history of the Eureka Mining District has been excerpted from *Geochemistry of soil contamination from lead smelters near Eureka Nevada* (Chaffee and King, 2014):

Silver-rich deposits were first discovered in the district in New York Canyon in 1864. The peak production of mining was between about 1870 and 1880. By the 1890s, most of the bonanza Pb-Ag ore bodies were exhausted, and mining of these deposits largely ended by 1898 (Earl, 1988). Mining around Eureka for both base and precious metals continued intermittently on a smaller scale throughout the 20th century and continues to the present day. The high-grade Pb-Ag ores of the Eureka district were mostly contained in weathered gossans present in host rocks composed of limestone or dolomite. At the time of the initial discovery of the ores in 1864, no established technology existed to recover the Pb and Ag from this strongly oxidized ore material (Winzeler & Peppin, 1982; Earl, 1988). In 1869, a method was perfected to mill and smelt these ores, and eventually 19 smelters were constructed in and near Eureka. Of these, the Richmond Company smelter and the Eureka Consolidated smelter were the largest. During the 1870s, the Richmond Company smelter was built at the south end of Town, and the Eureka Consolidated was built at the north end (Earl, 1988; James, 1988). Because of the continued decline of recoverable ores and of the price of Pb and Ag after 1880, the Richmond Company smelter ceased operations in 1889, followed by the Eureka Consolidated smelter in 1891.

Although the peak production ended in 1891, mining and smelting operations continued intermittently. “A five-year revival began in 1906 when the districts two large companies merged to form Richmond-Eureka Consolidated." Leasers continued to work some of the mines up through 1940 (Paher, 1970).

2.2.2 Mills and Smelters History

According to information obtained from *A Historic View of the BLM Shoshone-Eureka Resource Area, Nevada, Technical Report 7* (BLM, 1991), between 1866 and 1910, mining for geological deposits of silver and lead took place in the Ruby Hill area, which is located approximately 2.0 miles west of Eureka. During this period, over one-million tons of ore were extracted from Ruby Hill primarily by the Eureka Consolidated Mining Company and Richmond Consolidated Mining Company. The ore mined from Ruby Hill was then transported via railcar to various milling and smelter operations historically located throughout Eureka. The following historic ore milling and smelter operations were identified in Eureka and are shown on Figure 2.

- Lemon Mill
- McCoy's Mill
- Eureka Consolidated Smelter (ECS)
- Matamoras Smelter
- Hoosac Smelter
- Atlas Smelter
- Richmond Company Smelter (RCS)
- Jackson Smelter
- Silver West Smelter
- Taylors Mill

2.2.3 Slag Piles History

As a result of ore processing at these former mills and smelter sites, waste product known as slag was produced and consolidated into a number of separate piles located throughout Eureka. Two large slag piles, associated with the ECS and the RCS, are located along Highway 50 on the north and south ends of Eureka. At least two additional, smaller slag piles are present in town and are also depicted in Figure 2. These include slag piles associated with the Atlas and Matamoras smelters. Over time, it is believed that slag material may have been moved around town for various purposes. As described below, previous authors have reported high concentrations of lead and arsenic in the slag piles.

The old metallurgists were fairly skillful and the ores were of easy smelting character. Consequently the slags are not very rich; certainly not rich enough to rework. They are said to contain from 2 to 3 ounces silver per ton and 1% to 2% lead. However, there are large accumulations of speiss, which may someday be a source of value. The formation of this compound, due to the arsenic in the ore, was always a great trouble to the Eureka metallurgists. They could not cleanly extract its gold, silver, and lead, and cast it aside in cones, which glisten brilliantly on the dumps today. I was informed by an official who had long been connected with the Eureka Consolidated that the amount of speiss in the Eureka and Richmond dumps is probably between 130,000 and 200,000 tons, and that it contains 30% arsenic, 3% lead, 2% copper, and 2 to 3 ounces silver and $3 to $4 gold per ton. If these figures are approximately correct, there is in these dumps a great resource of arsenic, enough to supply the domestic consumption for many years. The high percentage of arsenic noted in the bag-house fume at the U.S. Smelter at Salt Lake undoubtedly comes from the smelting of the Eureka ore (Ingalls, 1908).

2.2.4 Historic Health Effects Attributed to Mining and Smelting

Due to the extensive amount of historic ore processing operations in Eureka, it has been reported in several documents that air pollution lead to health problems in residents and former smelter workers, during the period when the smelters were operating. According to the book *Nevada Ghost Towns and Mining Camps* by Stanley Paher, 1970:

> *On the outskirts of Town, 16 smelters with a daily capacity of 745 tons treated ore from over fifty producing mines. Furnaces poured forth dense clouds of black smoke which constantly rolled over the Town and deposited soot, scales and black dust everywhere, giving the Town a somewhat somber aspect and killing vegetation. The 'Pittsburgh of the West,' Eureka was indeed the foremost smelting district in the entire West.*

Impacts to human health caused by smelting operations were also described by Ingalls in "Lead and zinc in the United States Comprising an economic history of the mining and smelting of metals and the conditions which have affected the development of the industries, 1908":

Eureka, Nevada was one of the many significant boom-mining Towns that sprang up in the early days of the settlement of the western U.S. Early (pre-1900) mining and smelting in the Eureka area (Curtis, 1884; Winzeler & Peppin, 1982) were commonly conducted with little understanding of the effects of mining activity on the environment or human health. As a result, mine dumps were generally located adjacent to mine portals, regardless of drainage considerations or proximity to housing. Likewise, structures for treating ores—mills and smelters—as well as slag piles, were generally constructed close to the sources of ores or to railroads (Earl, 1988). The effects of the dispersion of liquid or particulate effluents from these smelter locations were thus not seriously considered in locating these structures. As a result, the potential remains for health risks from these historic mining and processing operations.

Still other historical documents report health effects related to smelting activities. "Like most frontier communities, Eureka had a high death rate. In addition to the usual run of accidents associated with horses, wagons and mules, home accidents, gunshots and normal ailments which led to death because of a lack of proper treatment, the people suffered from smelter fumes emanating from the industrial plants on both ends of Town. Although few recognized the ailment, they were suffering from lead poisoning" (Earl et al., 1988).

2.2.5 Historic Flood Events

There were several flood events, including a major flood event in 1874 that swept away homes and buildings and caused 15 fatalities (Nevada Historical Society, 1988). A similar flood event in

1910 washed out the railroad (Paher, 1970). These same flood events likely redistributed contamination through the Town. Eureka creek flows from south to north and eventually discharges to a flat, alluvial plain located approximately 5.0 miles north of Eureka.

2.3 SITE POPULATION AND LAND USE

The Town of Eureka is located towards the southeast corner of the county, and is the county seat. “Primarily a mining, ranching, and agricultural county, Eureka County is rural in nature. The county is approximately 2.7 million acres in size and encompasses approximately 4,182 square miles. The BLM manages approximately 74% of public lands in Eureka County. The U.S. Forest Service Austin Ranger District manages the Monitor Range, which terminates in the southern portion of the county” (Douhan et al., 2008).

Eureka County is the second least populated county in Nevada. The Nevada State Demographers Office estimated that the 2012 population of Eureka County was 2,071 while the Town of Eureka’s population was 720.

The Nevada Department of Employment, Training, and Rehabilitation listed mining as the major employer in the county. “Although not a major employer, agriculture is important to the county’s economy and has remained a consistent economical industry in the county, unlike mining which has seen a series of booms and busts” (Douhan et al., 2008).

The Town occupies approximately 480 acres within an elongated, roughly rectangular area (see Figure 2). The Town of Eureka is completely surrounded by BLM-administered land.

Neither Eureka County nor the Town of Eureka has zoning regulations. As such, no distinction is made between residential and commercial properties. Parcels are identified as either occupied or unoccupied. Occupied parcels are then considered residential or commercial, based solely on actual land use, rather than any specific zoning designation.

The following information regarding the number of designated parcels in Eureka was provided by the Eureka County Assessor:

- Total number of parcels within the Town of Eureka = 563
- Total number of residential parcels within the Town of Eureka = 234
- Total number of commercial parcels with the Town of Eureka = 76
- Total number of publicly owned parcels (county, school or otherwise) =164
- Total number of vacant parcels within the Town of Eureka = 194

Included among the identified parcels are Eureka School District parcels (refer to Figure 2 for locations), which include the following facilities:

- **Eureka High School** – encompasses a total of approximately 45.0 acres, of which approximately 10.0 acres appear utilized by the school and are covered with structures or paved surfaces. The remaining 35.0 acres consist of undeveloped land.

- **Eureka School District Athletic Complex** – encompasses a total of approximately 12.4 acres, of which approximately 5.0 acres are covered by structures and recently constructed synthetic surface sports fields. The remaining 7.4 acres consist of unpaved parking areas and undeveloped land.
- **Eureka Elementary School Property** – consists of three parcels that encompass approximately 6.8 acres, of which 3.5 acres are school structures, concrete surfaces, asphalt paving or other landscape areas. The remaining 3.3 acres are a large fenced-in playground and play fields.
- **Former Eureka School Property –** encompasses a total of 2.9 acres located east of the Eureka High School facility, and consists of a vacant school building, gymnasium facility, play field, small playground, and two residential structures.

Also included among the identified parcels are the Eureka County Fairgrounds and Eureka County ballfields and parks (also refer to Figure 2 for locations), which include the following facilities:

- **Eureka County Fairgrounds –** The Eureka County Fairgrounds consist of 27.55 acres located at the north end of Town, on the east side of Highway 50.
- **Eureka County Baseball Field –** The baseball field (also referred to as the lower ball park) is situated at the south end of Town, on the west side of Highway 50. The ball park area is approximately 6.0 acres in size and includes a baseball field, seating areas and parking areas. There is a small play structure, consisting of large truck tires, adjacent to the left field area.
- **Eureka County Softball Field –** The softball field (also referred to as the upper ball park) is situated at the south end of Town (south of the baseball field), on the west side of Highway 50. This area is approximately 3.5 acres in size and includes a softball field, seating areas, parking areas, and a playground.
- **Eureka City Park –** This park is located on Buel Street, one block east of Highway 50. The park is approximately 0.4 acres in size. Facilities at the park include a grassy play area, picnic area, and restrooms.

The Town of Eureka contains many historical buildings, and the entire community is designated as a historic district and is listed in the National Register of Historic Places and the Nevada State Register of Historic Places.

2.4 SITE CLIMATE

The climate of Eureka is typical of the northern Great Basin. Summer temperatures fluctuate throughout the 90s (degrees Fahrenheit [°F]) during the day, but cooling downdrafts from surrounding mountain ranges usually push nighttime temperatures into the mid-40°F range. Average July temperatures range between 65°F and 75°F. The highest temperature ever recorded in the county was 108°F. Winters are generally moderate, although occasional blasts of colder arctic air can settle in the region for short periods of time. January temperatures average about 30°F, although much colder temperatures can occur locally (-42°F is the lowest ever recorded in the area). Humidity and precipitation are typically low. Average precipitation ranges from less than 10 inches per year on the valley floors, to as much as 20 inches per year in the mountains (Kehmeier, 2006).

The following climatological data, for the period from April 1, 1888, to March 31, 2013, was obtained from the Western Regional Climate Center.

Table 1: Average Eureka Climatological Data for April 1988 - March 2013

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	38.3	41.2	48.3	57.0	66.0	77.2	86.4	84.3	74.9	63.3	48.8	39.7	60.4
Average Min. Temperature (F)	17.1	19.2	23.9	28.9	36.4	44.1	53.0	52.0	43.8	34.6	24.5	18.3	33.0
Average Total Precipitation (inches)	1.01	1.05	1.34	1.34	1.41	0.83	0.68	0.78	0.78	0.89	0.78	0.89	11.83
Average Total Snow Fall (inches)	9.4	9.8	10.2	7.0	3.6	0.4	0.1	0.0	0.6	2.4	6.1	9.4	58.9
Average Snow Depth (inches)	3	2	1	0	0	0	0	0	0	0	1	2	1

The historic wind direction through the Town, as documented by the Western Regional Climate Center based on Eureka Airport data, is predominately from the south to the north. A wind rose for this site is included as Figure 3.

2.5 SITE GEOLOGY

The following information regarding the geology of the Eureka Mining District has been excerpted from *Geochemistry of Soil Contamination from Lead Smelters Near Eureka Nevada* (Chaffee and King, 2014):

The Eureka mining district is in the Nevada part of the Basin and Range Physiographic Province of the U.S. The geology of the mining district and vicinity has been described in detail elsewhere (Hague, 1883, 1892; Nolan, 1962; Nolan *et al.,* 1971, 1974; Dilles *et al.* 1996; Vikre, 1998) and is only summarized here. The area included in the present study covers the part of the district around the Town of Eureka and to the north comprises mostly Tertiary and Quaternary gravels and Quaternary alluvium. Directly east of the Town of Eureka, the hillsides are largely composed of andesites of the Tertiary Richmond Mountain Andesite (Nolan, 1962; Nolan *et al.,* 1971, 1974). Also present both to the east of Eureka and in scattered localities in and west of Eureka are small outcrops of a white, air-fall bedded tuff and intrusive rhyolite that are included in the Tertiary Pinto Peak Rhyolite. None of the above units is mineralized.

The south and west parts of the study area include outcrops of the Newark Canyon Formation (Cretaceous), the Carbon Ridge Formation (Permian), the Diamond Peak Formation (Mississippian), and the Chainman Shale (Mississippian). None of these pre-Tertiary units is mineralized. South and/or west of Eureka are locally mineralized units, including the Hanson Creek Formation (Ordovician), the Pogonip Group (Ordovician), and the Eureka Quartzite (Ordovician) and small zones containing dikes and sills of quartz-rich porphyritic rocks. The Eldorado Dolomite and Hamburg Dolomite, also south and west of Eureka, are the most important ore hosts in the district.

During the period in which the smelters were operating, mining in the Eureka district was mostly of ores of Pb, Ag, and Au. In addition to these three elements, analyses of these ores reported the minor and trace elements As, Bi, Cd, Cl, Co, Cu, Hg, Mn, Mo, Ni, P, S, Sb, Se, Sn, W, and Zn, as well as the major elements Al, Ca, Fe, Mg, and Si (Curtis, 1884; Hague, 1892; Nolan, 1962; Vikre, 1998). Most of the ores mined consisted of highly oxidized minerals; sulphide minerals were only a minor part (Curtis, 1884; Nolan, 1962).

2.6 SITE HYDROLOGY

Diamond Valley is located outside of the study area for this EE/CA. However, a description of the Diamond Valley hydrology is included here since wells located in Diamond Valley are the primary source of drinking water for the Town of Eureka. The wells are approximately 4 to 5 miles north of the Town of Eureka. Hydrologic conditions within Diamond Valley are described below, as excerpted from *Hydrogeologic Framework and Ground Water in Basin-Fill Deposits of the Diamond Valley Flow System, Central Nevada* (Tumbusch, M.L. and Plume, R.H., 2006):

The Diamond Valley flow system, an area of about 3,120 square miles in central Nevada, consists of five hydrographic areas: Monitor, Antelope, Kobeh, and Diamond Valleys and Stevens Basin. Although these five areas are in a remote part of Nevada, local government officials and citizens are concerned that the water resources of the flow system eventually could be further developed for irrigation or mining purposes or potentially for municipal use outside the study area. In order to better understand the flow system, the U.S. Geological Survey in cooperation with Eureka, Lander, and Nye Counties and the Nevada Division of Water Resources, is conducting a multi-phase study of the flow system.

The principal aquifers of the Diamond Valley flow system are in basin-fill deposits that occupy structural basins comprised of carbonate rocks, siliciclastic sedimentary rocks, igneous intrusive rocks, and volcanic rocks. Carbonate rocks also function as aquifers, but their extent and interconnections with basin-fill aquifers are poorly understood.

After 40 years of irrigation pumping, a large area of ground-water decline has developed in southern Diamond Valley around the irrigated area. In this part of Diamond Valley, flow is from valley margins toward the irrigated area. Ground-water levels in the Diamond Valley flow system have changed during the past 40 years. These changes are the result of pumpage for irrigation, municipal, domestic, and mining uses, mostly in southern Diamond Valley, and annual and longer-term variations in precipitation in undeveloped parts of the study area. A large area of ground-water decline that underlies an area about 10 miles wide and 20 miles long has developed in the basin-fill aquifer of southern Diamond Valley. Water levels beneath the main part of the irrigated area have declined as much as 90 feet. In undeveloped parts of the study area, annual water-level fluctuations generally have been no more than a few feet.

2.7 SITE DRINKING WATER

The Town of Eureka receives drinking water from the Eureka Water Association Public Water System, which is owned, operated and maintained by the Eureka County Public Works Department. The Eureka water system serves 323 customers, both residential and commercial. The current sources of drinking water for the system are two wells in Diamond Valley, north of Town. Water is pumped to two storage tanks, one at the north end of Town and one at the south end, which have a combined storage capacity of 2.35 million gallons. From the tanks, water feeds by gravity to the distribution system. The water source also includes several springs, which have not been in use for some time, but have recently undergone rehabilitation and development in anticipation of re-introducing the springs to the Town's water source. Once Eureka County Public Works completes initial monitoring and the Nevada Division of Environmental Protection's (NDEP) Bureau of Safe Drinking Water gives approval, the springs will be used to supplement the current supply from the Diamond Valley wells. There are 10 springs with the potential to serve as supplemental sources, and all are located in the hills just south of Eureka. All springs are channeled to a common collection box on the outskirts of Town.

The Eureka Water Association routinely monitors for constituents in drinking water according to federal and state laws. Results of monitoring for the period of January 1 to December 31, 2012, indicate that all constituents, including arsenic, were below drinking water standards. The last documented drinking water test for lead was in August 2013, as the Safe Drinking Water Act does not require testing for lead. Previous limited testing indicated that lead concentrations were below the Treatment Technique level of 0.015 milligrams per liter (mg/L). Lead and copper concentrations are regulated by a Treatment Technique that requires water systems to control the corrosiveness of water. If more than 10% of tap water samples exceed the action level, water systems must be evaluated for additional steps to address the exceedance(s). For copper the action level is 1.3 mg/L, and for lead it is 0.015 mg/L.

2.8 SITE FLORA AND FAUNA

"The vegetation of Eureka County is typical of the northern and central Great Basin. Greasewood is found on salt flats, and sagebrush is ubiquitous from the edge of the salt flats to the crest of all but the highest mountains. Pinion, juniper, and mountain mahogany are typical trees in the mountain ranges" (Kehmeier, 2006).

The following table outlines the vegetative zones in Eureka County with typical species listed in order of ascending elevation.

Table 2: Eureka County Vegetative Zones and Predominant Species

Vegetative Zone	Predominant Species
Saltbrush	Shadescale
Sagebrush	Bitterbrush, Sagebrush, Desert Peach, Great Basin Sagebrush
Pygmy Conifer	Utah Juniper, Singleleaf Pinion
Montane	Mountain Mahogany, Aspen, Rocky Mountain Juniper
Subalpine	Limber Pine, Great Basin Bristlecone

Source: Charlet, D.A. 2007. Atlas of Nevada Vegetation, Volume I: Mountains. Unpublished work in progress.

Sagebrush is the most widespread vegetative zone, closely followed by the pygmy conifer and montane zones. Subalpine and saltbrush are the least common zones. Within Eureka, pinion and juniper woodlands, and sagebrush are identified as the predominant vegetative zones. Overall, wildland fire poses a moderate to high threat to 95% of the vegetative zones in Eureka County (Douhan et al., 2008).

As of March 5, 2008, the state of Nevada listed 24 animal and plant species as threatened under the federal Endangered Species Act (ESA) of 1973 (Natural Heritage Program, 2008). There is one federally-listed threatened or endangered species, and 16 species that are protected by Nevada state legislation with potential habitat in Eureka County (Douhan et al., 2008).

Table 3: Federal- and State-Listed Flora and Fauna at Risk – Eureka County

Scientific Name	Common Name	Legislation
Plants		
Castilleja salsuginosa	Monte Neva Indian Paintbrush	NRS 527.260.300
Fish		
Gila bicolor euchila	Fish Creek Springs tui chub	NRS 501
Oncorhynchus clarki henshawi	Lahontan cutthroat trout	ESA-Listed Threatened NRS 501
Mammals		
Brachylagus idahoensis	Pygmy rabbit	NRS 501
Euderma maculatum	Spotted bat	NRS 501
Lontra canadensis	River otter	NRS 501
Birds		
Accipiter gentiles	Northern goshawk	NRS 501
Athene cunicularia hypugaea	Western burrowing owl	NRS 501
Buteo regalis	Ferruginous hawk	NRS 501

Scientific Name	Common Name	Legislation
Birds (Continued)		
Centrocercus urophasianus	Greater sage-grouse	NRS 501
Charadrius alexandrines nivosus	Western snowy plover	NRS 501
Chlidonias niger	Black tern	NRS 501
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	NRS 501
Oreortyx pictus	Mountain quail	NRS 501
Otus flammeolus	Flammulated Owl	NRS 501
Plegadis chihi	White-faced ibis	NRS 501

Source: U.S. DOI - BLM Nevada State Office – Mapping Sciences. Updated in 2003.
NRS- Nevada Revised Statutes

2.9 PREVIOUS INVESTIGATIONS

In 1978, the U.S. Department of Interior (DOI) Geological Survey collected 593 samples that identified a 3-kilometer (km) by 6-km area of contamination within the Eureka Mining District. The data were published in a 1978 report titled *Geochemical Analyses of Rock and Soil Samples, Eureka Mining District and Vicinity, Eureka and White Pine Counties* (M.A. Chaffee, 1978) and were discussed in subsequent papers including a 1987 report titled *Application of R-Factor Mode Analysis to Geochemical Studies in the Eureka Mining District and Vicinity, Eureka and White Pine Counties, Nevada* (M.A. Chaffee, 1987), and a 2004 publication titled *Hydrogeochemical Studies of Historical Mining Areas in the Humboldt River Basin and Adjacent Areas, Northern Nevada* (M.A. Chaffee, 2004). Additional field sampling was conducted in 2007, and the findings were reported in the subsequent paper *Geochemistry of soil contamination from lead smelters near Eureka Nevada (*Chaffee and King, 2014).

In April 2012, EPA and NDEP personnel collected five slag and soil samples from publically accessible locations within Eureka. These samples were analyzed by X-ray fluorescence (XRF) instrumentation, and high levels of arsenic and lead were identified.

In May 2012, EPA and NDEP personnel collected 38 additional surface soil samples from publically accessible locations throughout Eureka for lead and arsenic analyses. Analytical results indicated that five samples contained arsenic concentrations below 60 milligrams per kilogram (mg/kg), 23 samples contained arsenic concentrations between 60 and 600 mg/kg, and 10 samples contained arsenic concentrations above 600 mg/kg. The arsenic concentrations in samples ranged from 10 to 6,700 mg/kg.

The analytical results for lead indicated that 10 samples contained lead concentrations below 400 mg/kg, 20 samples contained lead concentrations between 400 and 5,000 mg/kg, and eight samples contained lead concentrations above 5,000 mg/kg. The lead concentrations ranged from 44 to 45,000 mg/kg. The highest lead soil concentrations were detected at the slag piles located at the north and south ends of Eureka, and at former smelter site locations.

In October 2012, EPA conducted a Removal Assessment in Eureka. The findings of this Removal Assessment were presented in the document *Eureka Smelter Site, Removal Assessment Report, Eureka, Eureka County, Nevada, March 2013* prepared for EPA by (Ecology and Environment, Inc. [E & E], 2013a). Surface and shallow subsurface soil samples were collected from residential and public properties located throughout Eureka, where access rights were granted by the owners to EPA and NDEP. A total of 268 decision units from 106 individual residential and public properties were sampled during this removal assessment.

In May 2013, EPA conducted a second removal assessment in Eureka. The findings of this removal assessment were presented in the document entitled, *Addendum Letter Report to the Eureka Smelter Site Removal Assessment Report, Eureka, Eureka County, Nevada, October 14, 2013* prepared for EPA by E & E (E & E, 2013b). Surface and shallow subsurface soil samples were collected from an additional 20 residential and vacant properties.

In conjunction with removal actions conducted in the fall of 2013, and spring and summer of 2014, EPA collected surface and shallow subsurface soil samples from additional properties. A total of 28 properties were sampled in conjunction with the 2013 removal action, and a total of 59 properties were sampled in conjunction with the 2014 removal action, bringing the total number of properties sampled to 215. These results are reported in the following documents: *2013 Final Report Soil Removal Action at Residential Properties Eureka Smelter Sites Eureka, Eureka County, Nevada* prepared for EPA by E & E (E & E, 2013c) and *2014 Final Report Soil Removal Action at Residential Properties Eureka Smelter Sites Eureka, Eureka County, Nevada* prepared for EPA by E & E (E & E, 2014a).

In conjunction with the removal action performed in the summer of 2014, EPA also conducted lead-based paint (LBP) testing and an indoor dust assessment at a limited number of residential properties. This sampling was offered to property owners where soil removal actions were underway. Five property owners consented to this sampling. As part of these efforts, interior and exterior LBP testing was performed, wipe samples were collected from interior hard surfaces, and vacuum samples were collected from carpeted floors. The results of these assessments were presented in separate Residential Assessment Reports regarding lead and LBP contamination. These reports were completed in September 2014.

In July 2013, the Nevada State Health Division, in coordination with the Eureka County Health Clinic, conducted initial blood lead level testing using finger-stick methodology. Beginning in December 2013, blood lead testing was again offered to Eureka residents on an ongoing basis. This testing is being provided by the Eureka County Health Clinic, via a grant administered by NDEP.

2.10 PREVIOUS REMOVAL ACTIONS

EPA has conducted two removal actions to address residential properties with the highest levels of lead and arsenic in soil. EPA and NDEP identified immediate action levels of 3,000 mg/kg lead and 600 mg/kg arsenic. EPA offered to conduct cleanup at residential properties with soil contamination exceeding these immediate action levels. In a few instances, EPA also offered to conduct cleanup at residential properties where soil contamination approached the immediate action levels and where young children were known to be present.

Between September 9 and November 8, 2013, EPA conducted the initial removal action in Eureka. This work included soil removal and backfilling at 17 residential properties where highly elevated lead and arsenic soil concentrations in surface soil were found. An area at the Eureka Elementary School was also remediated.

Between April 28 and July 23, 2014, EPA conducted the second removal action in Eureka. This work included soil removal and backfilling at 26 residential properties where highly elevated lead and arsenic concentrations in surface soil were found.

The areas of concern (AOC) for the removal actions were identified during previous EPA removal assessments. Excavation of contaminated soil was performed using heavy equipment and also by hand digging. Contaminated soils were removed to a maximum excavation depth of 1 foot. Excavated soil was transported to a temporary soil storage area. A rock cover was placed over the temporary soil storage area to prevent wind erosion, and drainage controls were constructed around the perimeter. Prior to backfilling excavated areas, a grid of yellow marker tape was placed over any areas where lead or arsenic concentrations still remained above 400 mg/kg for lead, or 60 mg/kg for arsenic. Excavation areas were then backfilled with clean fill materials, compacted, graded, and restored to original landscaping. At several locations, the AOC was not excavated, but capped in place with soil or crushed rock. All fill material was sampled to document concentrations of lead, arsenic, barium, cadmium, chromium, mercury, selenium, and silver were significantly below any health-based benchmarks.

3. SOURCE, NATURE AND EXTENT OF CONTAMINATION

3.1 CONTAMINANTS OF CONCERN

To date, EPA has collected and analyzed more than 2,500 soil samples for lead and arsenic contamination. The lead and arsenic concentrations range up to more than 100,000 mg/kg for lead and 32,000 mg/kg for arsenic. Statistics regarding the number of samples and their respective concentration ranges are provided in the following table.

Table 4: Total Number of Contaminated Samples and Properties

	Total	**Number of samples that are ≥3,000 mg/kg lead**	**Number of sample that are ≥1,200 mg/kg lead**	**Number of samples that are ≥400 mg/kg lead**	**Number of samples that are <400 mg/kg lead**	**Number of samples that are ≥250 mg/kg lead**	**Number of Samples that are <250 mg/kg lead**
Number of Samples	2,558	469	1,033	1,687	871	1,911	647
Percent		18%	40%	66%	34%	75%	25%
		Number of sample that are ≥ 600 mg/kg arsenic	**Number of sample that are ≥ 180 mg/kg arsenic**	**Number of sample that are ≥ 60 mg/kg arsenic**	**Number of sample that are < 60 mg/kg arsenic**		
Number of Samples	2,557	378	1,035	1,805	752		
Percent		15%	40%	71%	29%		
	Total Number Sampled	**Number of properties with one or more samples ≥ 3,000 mg/kg lead or ≥ 600 mg/kg arsenic**	**Number of properties with one or more samples ≥ 1,200 mg/kg lead or ≥180 mg/kg arsenic**	**Number of properties with one or more samples ≥ 400 mg/kg lead or ≥ 60 mg/kg arsenic**	**Number of properties with all samples < 400 mg/kg lead and < 60 mg/kg arsenic**		
Number of Properties	215	92	148	193	22		
Percent		43%	69%	90%	10%		

As part of the initial removal assessment, 44 randomly selected soil samples were also analyzed for 14 additional metals by the EPA Region 9 Laboratory. The concentration range for each of these metals and the corresponding November 2012 EPA Regional Screening Levels (RSLs) for soils in a residential scenario are summarized below.

- Antimony concentrations ranged from less than 2 mg/kg to 180 mg/kg; the residential RSL for antimony is 31 mg/kg.
- Barium concentrations ranged from 99 mg/kg to 680 mg/kg; the residential RSL for barium is 15,000 mg/kg.
- Beryllium concentrations ranged from 0.67 mg/kg to 1.4 mg/kg; the residential RSL for beryllium is 160 mg/kg.
- Cadmium concentrations ranged from 0.54 mg/kg to 76 mg/kg; the residential RSL for cadmium is 70 mg/kg.
- Total chromium concentrations ranged from 5.9 mg/kg to 17 mg/kg; the residential RSL for hexavalent chromium is 0.29 mg/kg and the residential RSL for trivalent chromium is 120,000 mg/kg. An RSL for total chromium has not been established.
- Cobalt concentrations ranged from 2.2 mg/kg to 6.7 mg/kg; the residential RSL for cobalt is 23 mg/kg.
- Copper concentrations ranged from 9.8 mg/kg to 190 mg/kg; the residential RSL for copper is 3,100 mg/kg.
- Molybdenum concentrations ranged from less than 2.5 mg/kg to 280 mg/kg; the residential RSL for molybdenum is 390 mg/kg.
- Nickel concentrations ranged from 5.2 mg/kg to 14 mg/kg; the residential RSL for nickel is 1,500 mg/kg.
- Selenium concentrations ranged from less than 2.0 mg/kg to 2.4 mg/kg; the residential RSL for selenium is 390 mg/kg.
- Silver concentrations ranged from less than 0.5 mg/kg to 26 mg/kg; the residential RSL for silver is 390 mg/kg.
- Thallium concentrations ranged from less than 2.5 mg/kg to tentative estimated concentration of 2.9J mg/kg; the residential RSL for thallium is 0.78 mg/kg
- Vanadium concentrations ranged from 19 mg/kg to 87 mg/kg; the residential RSL for vanadium is 390 mg/kg.
- Zinc concentrations ranged from 64 mg/kg to 2,000 mg/kg; the residential RSL for zinc is 23,000 mg/kg.

The following general conclusions can be made from a review of the survey data.

- Antimony was at concentrations above the EPA residential RSL in 10 of the 44 samples.
- Samples that exceeded the Elevated Site Screening Level (ESSL) for either arsenic or lead also exceeded the EPA residential RSL for antimony.
- The antimony concentration in background soil samples had a mean concentration of 10 mg/kg.

- Other than thallium and arsenic, metal concentrations in background samples were well below the EPA residential RSLs.
- Cadmium concentrations were above the EPA residential RSL in one of the 44 samples.
- No samples were above the EPA non-residential RSL for antimony or cadmium.
- Thallium in soil typically has a method detection limit that is above the EPA residential RSL. The method detection limit at EPA Region 9 Laboratory was 2.5 mg/kg, with a laboratory quantitation limit of 5.0 mg/kg. Both of these values are also above the EPA residential RSL of 0.78 mg/kg. No sampling results were reported above the laboratory's quantitation limit.
- All samples with antimony or cadmium concentrations above the EPA residential RSL also contained lead and arsenic concentrations significantly above the RSLs.
- Based on this information, EPA has identified lead and arsenic as the primary contaminant of concern (COC) for this Site.

3.2 CONTAMINATION SOURCES

Investigations conducted to date have depicted wide-spread lead and arsenic soil contamination throughout Eureka. This contamination is primarily attributed to historic smelting and milling operations. The majority of designated parcels within Eureka are either on, adjacent to, or in close proximity to the sites of the former ore smelters and milling operations.

The following subsections provide information related to the evaluation of certain areas as potential contaminant sources within Eureka.

3.2.1 Former Smelter and Mill Sites and Slag Piles

While the majority of the structures and features associated with the former mill and smelter sites are no longer present, soil within and adjacent to the footprint of these facilities is likely to have significant contamination. Slag piles still remain at some of these locations. In particular, there are two large slag piles associated with the ECS and the RCS. At least two other slag piles are also present, including those associated with the Atlas and Matamoras smelters.

Many of these former mill and smelter sites have since been developed, and are now either residential or commercial properties. Others remain as undeveloped parcels. A summary of sampling data from each of the smelter or mill sites is presented below and also in Figures 4 through 9.

Lemon Mill

The footprint of the former Lemon Mill is approximately 0.57 acres (Figure 4). There is currently a commercial business present at this location, and EPA has not conducted any sampling at this location. There is a small ranch immediately to the north, and the slag pile associated with the ECS is located just to the south.

ECS

The footprint of the former ECS is approximately 14.86 acres (Figures 4). Highway 50 runs north to south through the center of the footprint. There are two residential properties within the southeast corner of the footprint. A removal action was conducted at one of these properties. There are also several residential properties adjacent to the southeast corner of the footprint, and removal actions were conducted at two of these properties. The western and southern portion of the ECS footprint consists of vacant land parcels, which have been sampled and found to contain high levels of lead and arsenic (lead concentrations in excess of 45,000 mg/kg and arsenic concentrations in excess of 11,000 mg/kg). Immediately to the west of the footprint, there are additional residential and vacant properties, some of which have been sampled by EPA.

There is a large slag pile associated with the ECS. This slag pile is directly adjacent to Highway 50, is approximately 3.25 acres in size, and has an estimated slag volume of 18,400 cubic yards (CY). Concentrations of lead in excess of 27,000 mg/kg and arsenic in excess of 25,000 mg/kg have been found in slag samples. Eureka Creek is located just to the east of the slag pile.

The slag pile has a hummocky, irregular topography and appears to consist of several distinct types of material. The westernmost lobe of the slag pile consists of a highly vitrified material, dark black in color. Within this lobe are two spires, with nearly vertical sidewalls. The central lobe consists of rocky material, similar in color and appearance to the material in the western lobe, but not as vitrified. The eastern lobe consists of a sand-like material that is brown in color, much finer grained, and much less vitrified than the material in the western and central lobes.

Taylors Mill

The footprint of the former Taylors Mill is approximately 6.02 acres (Figures 5). The eastern portion of the footprint consists of residential properties, some of which of were sampled by EPA. The central and largest portion of the footprint consists of vacant land, which has been sampled by EPA. Lead and arsenic concentrations occurred in excess of 5,200 mg/kg and 970 mg/kg, respectively. There are several residential properties along the eastern edge of the footprint. There are also several undeveloped parcels on the western edge of the footprint, which have also been sampled by EPA.

Matamoras Smelter

The footprint of the former Matamoras Smelter is approximately 2.99 acres (Figure 6), and consists of commercial and residential properties. There are numerous residential properties to the west and north of the footprint. Several of the residential properties have been sampled. A removal action was conducted at a property located just to the north of the footprint. Portions of the footprint appear to have been graded for development.

There is a small slag pile associated with the Matamoras Smelter. This slag pile is 0.04 acres in size and has an estimated slag volume of 800 CY. The slag pile is located just behind a small motel and appears to extend beneath an adjacent road. The material in this slag pile is similar in appearance to the material in the Hoosac slag pile and the western lobe of the RCS slag pile.

Hoosac Smelter

The footprint of the former Hoosac Smelter is approximately 3.04 acres (Figure 7), and consists mostly of vacant land with a rolling topography that has been sampled by EPA. The eastern portion of the vacant land dips steeply to the east toward residential property. Soil samples from the vacant property revealed lead and arsenic concentrations in excess of 100,000 mg/kg and 32,000 mg/kg, respectively. Elevated levels of lead and arsenic were also detected in soil samples collected on the residential property east of the former smelter. There is also a residential property to the west and northwest of the footprint.

Atlas Smelter

The footprint of the former Atlas Smelter is approximately 2.05 acres (Figure 7). A significant portion of the footprint consists of vacant land which has not been sampled. Removal actions were performed at numerous residential properties located within, or adjacent to, the footprint.

The slag pile associated with the Atlas Smelter is 0.28 acres in size and has an estimated slag volume of 3,500 CY. Residential properties are immediately adjacent to the eastern and southern sides of the slag pile. The Eureka County Health Clinic is located across the street, to the northeast of the slag pile. There is a utility pole located in the center of the slag pile. This slag pile consists of highly vitrified black, rocky, metallic-like material that is very similar in appearance to the slag in the RCS slag pile, and the western lobe of the ECS slag pile. A small amount of eroded slag is present along the sides of this slag pile.

Jackson Smelter

The footprint of the former Jackson Smelter is approximately 2.26 acres (Figure 8). There are several commercial and residential properties within the footprint, and most of them have not been sampled by EPA. There are also additional residential properties to the north and west.

RCS

The footprint of the former RCS is approximately 17.53 acres (Figures 8 and 9). A significant portion of the footprint is covered by a Eureka County building and an associated parking lot. The southeastern portion of the footprint consists of vacant land, which includes steep topography. Lead and arsenic levels on the hillside have been detected in excess of 46,000 mg/kg and 11,000 mg/kg, respectively. There are numerous residential properties immediately north of the footprint. Several of these properties have very high levels of lead and arsenic, and removal actions have been performed at multiple properties. Highway 50 and the Eureka Creek run along the west side of the footprint. There is also commercial property located on the west side of the footprint.

There is a large slag pile associated with the RCS. The slag pile is approximately 2.87 acres in size and has an estimated slag volume of 38,200 CY. Lead and arsenic concentrations at this location have been detected in excess of 44,000 mg/kg and 12,000 mg/kg, respectively. This slag pile lies just to the east of Highway 50, and extends eastward towards the hillside. Eureka Creek runs between the west side of the slag pile and Highway 50, and is clearly eroding the toe of the slag pile in some locations. The west and north sidewalls of the slag pile are very steep. The slag pile merges into a hillside on the east side and into the parking lot of the County Annex facility on the south side. The slag pile has a nearly flat surface that is interrupted by several large cavities, which are up to 30 feet wide and 10 feet deep.

This slag pile consists of highly vitrified, black, rocky, metallic-like material that is very similar in appearance to the western lobe of the ECS slag pile. With the exception of the eroded sidewalls on the east and north side, this slag pile appears to have much less fine-grained material compared to the ECS slag pile.

Silver West Smelter

The footprint of the former Silver West Smelter is approximately 4.93 acres (Figures 8 and 9). Much of the footprint is now covered by a trailer park, which has not been sampled by EPA. There are residential properties to the west and northwest of the footprint, and commercial properties to the east. These also have not been sampled by EPA.

McCoy's Mill

The footprint of the former McCoy's Mill is approximately 4.57 acres (Figure 8). Highway 50 runs north to south through the footprint. The Eureka County baseball field occupies a portion of the northwest corner of the footprint. The eastern portion of the footprint is covered by a commercial property, which has not been sampled by EPA.

3.2.2 Aerial Deposition from Smelting and Milling Operations

As discussed previously, plumes and aerial deposition from smelter stacks in Eureka have been reported in historic literature. "During the early period of operations of these two smelters, the solid effluents were simply exhausted through stacks directly above the smelter furnaces. During the peak production years, Eureka was described as the 'Pittsburgh of the West' (Winzeler & Peppin, 1982; James, 1988). The effects of the particulate effluents on the health of the citizens from lead (and probably other ore-related elements) were predictably detrimental, and as a result, in 1872 the smelter operators added flue stacks that ran up the hillsides near the two major smelters to raise the level at which the effluent was dispersed (Earl et al., 1988)."

While moving these stacks to the top of hillsides may have reduced impacts within the Town, this would have also resulted in a more widespread contaminant plume. It is also likely that dust emissions associated with the smelting and milling operations contributed to the distribution of contamination throughout Eureka. Eureka is situated within a north-south trending valley and the predominant wind direction is from south to north. A wind rose for Eureka is presented in Figure 3.

As part of the initial EPA removal assessment conducted in October 2012, EPA evaluated contamination associated with aerial dispersion. A total of 72 unique soil samples were collected from 36 locations on undeveloped property around the perimeter of the Town. Each location was sampled at two depth intervals. The air dispersion sampling area was sampled as a single decision unit with 36 discrete surface soil samples collected at a 0-2 inch below ground surface (bgs) interval, and 36 discrete shallow subsurface soil samples collected at a 2-6 inch bgs interval.

Elevated concentrations of lead or arsenic above the initial Site Screening Level (SSL) of 400 mg/kg for lead and 60 mg/kg for arsenic were found at 25 of the 36 sampling locations. Elevated concentrations of lead or arsenic above 10 times the SSL were found at five of the 36 sampling locations. Analytical results at all sampling locations showed significantly greater lead concentrations for the samples collected from the 0-2 inch bgs interval compared to samples collected from the 2-6 inch bgs interval. The average lead concentration at the 0-2 inch bgs interval ranged from two to three times the average lead concentration of the 2-6 inch bgs interval. The arsenic concentrations at sampling locations that were significantly greater than the arsenic SSL also showed significantly greater arsenic concentrations for the samples collected from the 0-2 inch bgs interval compared to samples collected from the 2-6 inch bgs interval. The average arsenic concentrations at the 0-2 inch bgs interval in these locations were two times the average arsenic concentration of the 2-6 inch bgs interval.

The lead concentration in shallow soil ranged from 56 mg/kg to 15,500 mg/kg. The arsenic concentration in shallow soil ranged from 12 mg/kg to 13,150 mg/kg. By contrast, the underlying soil ranged from 24 mg/kg to 5,500 mg/kg for lead, and 13 mg/kg to 1,100 mg/kg for arsenic.

The distribution of sampling locations with elevated lead and arsenic concentrations are significantly greater to the north and northeast of historic lead ore processing operations. Likewise, the distribution of elevated lead and arsenic concentrations are significantly greater at sampling locations that are closest to the historic lead ore processing locations.

The distribution of elevated lead and arsenic concentrations, the relatively higher surface contaminant concentration over sub-surface concentrations, and the predominant wind direction suggests that aerial deposition, likely from historic smelting operations, is the source of the documented contamination. An elliptical plume of soil contamination associated with aerial deposition from historical contamination has been identified by both EPA and previous investigators (Chaffee and King, 2014).

3.2.3 Eureka Creek

As part of the initial EPA removal assessment conducted in October 2012, EPA evaluated contamination associated with Eureka Creek, which flows from south to north through Eureka. A total of 45 unique discrete location sediment samples were collected from 15 decision units along the creek. Each location was sampled at three depth intervals. The creek was divided into a total of 15 decision units with discrete surface sediment samples collected at a 0-2 inch bgs interval, 15 discrete shallow subsurface sediment samples collected at a 2-6 inch bgs interval, and 15 discrete subsurface sediment samples collected at a 6-12 inch bgs interval.

Elevated concentrations of both arsenic and lead were found nearby and downstream of the ECS and RCS slag piles, which are located near the creek at both ends of the Town. Arsenic and lead concentrations upstream of both slag piles were significantly lower than concentrations downstream. Average downstream arsenic and lead concentrations in sediment samples collected from the creek were 300% to 400% higher than upstream concentrations.

Three discrete surface water samples were also collected from three decision units along the creek. All three surface water samples collected from the creek exceeded the 10 micrograms per liter (µg/L) SSL for arsenic, and one sample collected from the creek also exceeded the 35 µg/L SSL for lead.

Sediment within the creek is contaminated with lead and arsenic. The fact that arsenic and lead concentrations upstream of both slag piles were significantly lower than concentrations downstream, suggests that the creek bed is being impacted by the slag piles.

3.2.4 LBP and Indoor Dust

Concurrent with the removal action conducted in the summer of 2014, LBP testing and analysis of indoor dust was offered to property owners where removal work was being performed. This included testing of interior and exterior paint for lead, collection of wipe samples from interior surfaces, and vacuum-collection of samples from carpeted interiors. Five property owners consented to have the LBP and indoor dust testing performed. The following is a summary of the results:

- At two residences, multiple interior and exterior locations were identified as having painted surfaces with lead concentrations above the federal standard for LBP. At a third residence, there were no identified exterior or interior painted surfaces where lead concentrations were above the federal standard for LBP. The two other residences were of relatively new construction, so no LBP screening was performed.
- The assessment identified one residence with an elevated surface location where a collected sample contained lead at a concentration of 640 micrograms per square foot (µg/ft^2)—well above the Federal Residential Lead Dust Hazard Standard for window sills of 250 µg/ft^2. The assessment identified another residence with three interior floor surfaces that had lead concentrations above the Federal Residential Lead Dust Hazard Standard for floors of 40 µg/ft^2. At three residences, there were no sampled surfaces with lead concentrations above any of the Federal Residential Lead Dust Hazard Standards.

The property owners were all informed of the results of the LBP and indoor dust testing. In the cases where LBP was detected, owners were advised of the situation and information was provided regarding mitigation alternatives. At residences where dust was identified above federal standards, the property owners were advised to wipe down hard surfaces and a high-efficiency particulate air vacuum cleaner was provided for use on soft surfaces.

3.3 DISTRIBUTION OF CONTAMINATION WITHIN SOIL

3.3.1 Background Soil

EPA Removal Assessment Soil Background Data

As part of the initial EPA removal assessment conducted in October 2012, EPA evaluated background levels of lead and arsenic in soil in close proximity to Eureka. A total of 54 unique soil samples were collected from three areas on undeveloped property at locations greater than 3.0 miles south and north of the perimeter of the Town. Each area had six discrete sampling locations that were sampled at three depth intervals. In addition, a total of 12 composite soil samples were collected from two occupied residential properties at locations approximately

12.0 miles north of the perimeter of the Town. All samples had lead concentrations well below the SSL of 400 mg/kg. One sampled area had arsenic concentrations for all samples and each interval that were near the SSL of 60 mg/kg.

The background lead concentration for the 66 background samples ranged from 20 mg/kg to 250 mg/kg for the 0-2 inch bgs interval, 21 mg/kg to 140 mg/kg for the 2-6 inch bgs interval, and from 12 mg/kg to 52 mg/kg for the 6-12 inch bgs interval. The arsenic concentration ranged from non-detection to 120 mg/kg for the 0-2 inch bgs interval, non-detection to 89 mg/kg for the 2-6 inch bgs interval, and 12 mg/kg to 55 mg/kg for the 6-12 inch bgs interval.

From the background data, an average concentration for discrete samples was calculated as 52 mg/kg for lead and 19 mg/kg for arsenic. The background concentrations, based upon composite samples from the Diamond Valley properties, were calculated as 27.5 mg/kg for lead and 12 mg/kg for arsenic.

Statistical evaluation of all 66 background soil samples indicated a median lead concentration of 37 mg/kg and a mean lead concentration of 47 mg/kg. Calculation of the estimated average concentration based upon an upper confidence limit (UCL) evaluation indicated a 95% probability that the true mean concentration for lead in Eureka background soil is not greater than 50 mg/kg. Similarly, a median arsenic concentration of 13 mg/kg, and a mean arsenic concentration of 16.75 mg/kg were calculated. The calculation of the estimated average concentration based upon UCL evaluation indicated a 95% probability that the true mean concentration for arsenic in Eureka background soil is not greater than 20 mg/kg.

Following Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance, which dictates a documented observed release is three times background, the threshold concentrations of greater than 150 mg/kg for lead, and 60 mg/kg for arsenic were used to delineate potential contamination areas above background.

Published Soil Background Data

Published data on Nevada and Eureka area soil presented in a paper titled *Geochemistry of Soil Contamination from Lead Smelters Near Eureka Nevada*, The Geological Society of London, *2014* by A. Chaffee and King, calculated the median lead concentration to be 16.5 mg/kg for Nevada, and 50 mg/kg for the Eureka area. This study additionally calculated the median arsenic concentration to be 9 mg/kg for Nevada, and 10 mg/kg for the Eureka area.

The published median lead concentration of 50 mg/kg for Eureka area soil was based on a data set of 365 samples and is 35% greater than the EPA removal assessments' median lead concentration of 37 mg/kg, which was based on 68 samples. However, the median value of 50 mg/kg for Eureka area soil is similar to the mean and estimated average lead concentrations calculated during EPA removal assessments. The analytical method used to generate the published data was a method with precision and accuracy similar to current EPA methods.

The published median arsenic concentration of 10 mg/kg for Eureka area soil is also based on a 365-sample data set that was generated in the 1970s. The 10 mg/kg concentration is also the detection limit of the analytical method used for arsenic analysis. This median concentration is 30% less than the median concentration of 13 mg/kg calculated during EPA's removal assessments. However, this published median is significantly less than the calculated mean and estimated average arsenic concentration. The discrepancy between published arsenic data and EPA removal assessment data is believed to be based on the difference between the more accurate and precise EPA methods currently used in comparison to the less precise and sensitive arsenic analytical methods used in the 1970s.

3.3.2 Distribution of Contamination within Soil at Residential Properties

To date, EPA has sampled 215 properties in Eureka. A breakdown of these properties by land use is provided in the following table.

Table 5: Total Number of Properties Sampled for Assessment

Property Land Use Description	Number of Properties
Total number of sampled properties in Eureka including right-of way and BLM property	215
Total number of sampled properties in Eureka with Assessor Parcel Numbers - other than BLM property	211
Single Family Residential Properties in Eureka	106
Vacant Properties in Eureka	57
Schools, Parks, Ball Parks, and Sports Facilities in Eureka	12
Commercial Properties in Eureka	19
Multi-Residential Properties in Eureka	15
Other Properties in Eureka	2

As defined in the Handbook (EPA, 2003), residential properties include any area with high accessibility to sensitive populations, and properties containing single- and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, day-care centers, community centers, playgrounds, parks, green ways, and any other areas where children may be exposed to site-related contamination media.

Soil sampling and analysis conducted at each residential property was performed following procedures identified in the Handbook. Generally, these procedures involved dividing each property into decision units. Composite samples were collected from each decision unit at three separate depth intervals: 0-2 inches bgs, 2-6 inches bgs, and 6-12 inches bgs. In certain instances, point samples were collected from specific areas such as gardens and play areas. All samples were screened to 250 microns and were analyzed using XRF instrumentation. Approximately 20% of the samples were submitted to the EPA Region 9 Laboratory for analysis.

For each property sampled, a map was produced depicting the extent of contamination within each decision unit, at each of the three depths sampled. These individual property maps are available in the EPA removal assessment and removal action reports. Lead and arsenic isoconcentration maps (Figures 10 and 11) have been developed that depict the lateral extent of contamination in surface soils throughout Eureka.

While lead and arsenic soil contamination is widespread and present at elevated concentrations in the majority of parcels sampled, the concentrations vary significantly from property to property. The concentrations appear to vary as a function of proximity to former mill and smelter locations. This can be seen clearly in the lead and arsenic isoconcentration maps (Figures 10 and 11). In particular, residential parcels located on or in close proximity to the ECS at the north end of Town, the Atlas and Hoosac Smelters in the center of Town, and the RCS at the south of end of Town clearly have elevated levels of lead and arsenic in soil.

The vertical distribution of contamination is less well-defined. Generally, for most of the residential properties where significant contamination was identified, contamination was present at all three depth intervals, suggesting that removal of the top 12 inches of soil would still leave contaminated soil behind. In some instances, the top few inches of soil were less contaminated than soil at depth, suggesting that either contaminated material had been removed during development or clean fill had been imported.

3.3.3 Distribution of Contamination within Soil at Commercial Properties

EPA has sampled only a limited number of commercial properties in Eureka. Individual sampling maps have been produced for these properties and are available in the various EPA removal assessment and removal action reports. Trends in lateral and vertical distribution of contamination within soil are similar to those previously described for residential soil.

3.3.4 Distribution of Contamination within Slag Piles

Slag materials from both the ECS and RCS slag piles have been sampled and analyzed by EPA. Lead and arsenic concentrations have been detected in excess of 34,000 mg/kg and 25,000 mg/kg, respectively. While the slag piles tend to consist of vitrified material, loose granular material is also present at the slag piles, particularly in the central and eastern lobes of the ECS slag pile. None of the slag piles are fenced, and there is unrestricted public access to all of the slag piles. The Eureka Creek also flows in close proximity to the two large slag piles associated with the ECS and RCS, and fluvial erosion of these slag piles is evident. Additional leachability data and grain size analysis of slag material is presented in Section 4.

3.3.5 Distribution of Contamination within Soil at Unoccupied Properties

As discussed previously, neither Eureka County nor the Town of Eureka has zoning regulations. As such, no distinction is made between residential and commercial properties. Parcels are either identified as occupied or unoccupied. Occupied parcels are considered residential or commercial, based solely on actual land use, rather than any specific zoning designation. For purposes of this EE/CA, unoccupied or vacant parcels generally fall into one of several categories as outlined in the sections below.

3.3.5.1 Unoccupied parcels, located within or near the footprint of former mill or smelter sites, that could conceivably be sites of future development

These parcels, previously discussed in general in the context of former smelter and mill sites and slag piles (Section 3.2.1), are characterized as being within or near the footprint of previous mill and smelter sites. They tend to have very high levels of lead and arsenic (typically significantly greater than 3,000 mg/kg lead or 600 mg/kg arsenic).

3.3.5.2 Unoccupied parcels, not located within or near the footprint of former mill or smelter sites but are still within the area of potential impact of aerial deposition from mill or smelter sites, that could conceivably be sites of future residential development

These parcels are located outside of the footprint of former mill and smelter sites, but are still within the area that has been defined as being impacted by aerial deposition from the smelters. They are parcels characterized as likely having moderate levels of lead and arsenic contamination. Typically, contamination is limited to the top few inches of soil.

3.3.5.3 Vacant parcels that are outside the area of contamination

These parcels are located outside the area impacted by aerial deposition from the smelters and as such do not have levels of lead and arsenic in soil that significantly exceed background levels (three times background).

3.4 SURFACE WATER AND SEDIMENT CONTAMINATION

As previously discussed, EPA has collected water and sediment samples from Eureka Creek. Three discrete surface water samples were collected from three decision units along the creek. All three surface water samples collected from the creek exceeded the 10 µg/L SSL for arsenic, and one sample collected from the creek also exceeded the 35 µg/L SSL for lead.

Sediment within the creek is contaminated with lead and arsenic. The fact that arsenic and lead concentrations upstream of both slag piles were significantly lower than concentrations downstream suggests that the creek bed is being impacted by the slag piles.

3.5 GROUNDWATER CONTAMINATION

EPA is not aware of groundwater contamination issues associated with lead or arsenic in Eureka. As discussed in a previous section, the current sources of drinking water for the Town of Eureka are two wells in Diamond Valley, north of Town. The water source also includes several springs, which have not been in use for some time, but have recently undergone rehabilitation and development in anticipation of re-introducing the springs to the Town’s water source.

The Eureka Water Association routinely monitors for constituents in drinking water according to federal and state laws. Results of monitoring for the period of January 1 to December 31, 2012, indicate that all constituents, including arsenic, were below drinking water standards. Lead in drinking water in Eureka has not been routinely tested (the last documented test was in 2002), as the Safe Drinking Water Act does not require testing for lead. Limited, previous testing indicated that lead concentrations were below the treatment technique level of 0.015 mg/L.

4. ANALYTICAL DATA

During the course of conducting two removal assessments and two removal actions, samples from various media were collected and analyzed. These included the following:

- A total of 1,917 composite samples and 749 discrete samples were collected from property parcel locations in the Town of Eureka.
- A total of 45 unique and discrete sediment samples and three unique and discrete surface water samples were collected from Eureka's creek bed.
- A total of 72 unique and discrete soil samples were collected from a 1-mile wide perimeter outside the Town of Eureka.
- A total of nine unique composite samples and one stockpile composite sample were collected from unpaved roadways in the Town of Eureka.
- A total of 54 unique discrete samples and 12 unique composite samples were collected from background locations.
- Of the 2,910 total soil samples subjected to field XRF analysis, 523 (18%) were submitted to the EPA Region 9 Laboratory in Richmond, California, for confirmation analysis of arsenic and lead concentrations by EPA Method 6010B. Of these, 44 randomly selected soil samples were also analyzed for 14 additional metals by the EPA Region 9 Laboratory. Forty of the 254 soil samples were submitted to the laboratory based upon their elevated arsenic and lead concentrations identified during field XRF analysis for additional extraction using bio-accessibility extraction procedure EPA 9200.2-86, followed by analyses for total arsenic and lead concentration by EPA Method 6010B.
- Three surface water samples and a duplicate water sample were submitted to the EPA Region 9 Laboratory for analyses of arsenic, lead, and 15 additional metals by EPA Method 6010B.
- Ten equipment rinsate blank samples, which were collected daily during soil sampling activities, were submitted to the EPA Region 9 Laboratory for analyses of arsenic and lead concentrations by EPA Method 6010B.
- Three composite soil samples (generated from the collected samples) and four slag samples were submitted to the EPA Region 9 Laboratory for both toxicity characteristic leaching procedure (TCLP) and synthetic precipitation leaching procedure (SPLP) extraction with extract analyzed for the eight Resource Conservation and Recovery Act (RCRA) metals. Four slag samples were also submitted to a private laboratory for Meteoric Water Mobility Procedure (MWMP) analyses.
- In order to estimate the bioavailability percentage of lead and arsenic in soil samples collected from Eureka, a cross-section of 43 soil samples were selected and analyzed using bio-accessibility extraction procedure EPA 9200.2-86. Of these, six specially prepared composite soil samples were submitted to the EPA National Exposure Research Laboratory in Research Triangle Park, North Carolina, for a bioavailability study (i.e., an oral bioavailability of arsenic and lead in mice).

4.1 SOIL SAMPLING AND ANALYSIS

During EPA removal assessments and removal actions in Eureka, efforts were made to ensure that the quality of all data generated through XRF and laboratory soil sample analyses met appropriate established EPA criteria. To provide quality control (QC) for the analytical efforts, EPA SW-846 Method 6200 was adhered to during XRF soil sample analysis.

Soil samples collected to evaluate lead and arsenic concentrations were analyzed by trained personnel utilizing either an Innov-X Systems® or Olympus® Delta X field portable XRF unit. Prior to XRF sample analysis, each sample was prepared carefully, homogenized thoroughly, and placed into appropriate XRF analysis containers, and analyzed as an independent sample by EPA Method 6200. The concentrations of lead and arsenic from the obtained sample were reported.

Effective energy fundamental parameters calibration was performed during these field analytical efforts to ensure QC of the XRF unit. Effective energy fundamental parameters rely on pure element standards, standard reference material standards, and control standard samples.

To determine whether the XRF instrument was within resolution and stability tolerances, an energy calibration check was run with a pure manganese element standard at the beginning of each day as the first XRF analysis, at any time which the instrument detected that the characteristic x-ray lines were shifting, and at the end of each work day. To check the accuracy of the instrument and to assess the stability and consistency of analyses for lead and arsenic, a standard reference material was analyzed at the beginning of each day, after each set of 20 samples, and at the end of each work day. The measured value for each standard reference material run during field XRF analysis for the project was within ±20 percent standard deviation of the true value and considered acceptable.

Following field XRF analysis of soil samples, select samples incorporating a range of lead and arsenic concentrations were submitted for laboratory analysis. EPA Method 6200 suggests that a minimum of 5% to 10% of the XRF-analyzed samples be submitted to an analytical laboratory for confirmation analysis to verify the quality of the generated XRF data. During the EPA removal assessment and removal action activities, approximately 18% of the XRF-analyzed samples have been submitted for confirmation laboratory analysis.

Table 6: Summary of XRF and Laboratory Analyzed Site Samples

	Removal Assessment 2012	Removal Assessment 2013	Removal Action 2013	Removal Action 2014	Total
Unique Samples Analyzed by XRF	1,131	183	692	904	2,910
Submitted to R9 by EPA Method 6010	251	40	79	153	523
Percent Confirmation by EPA Method 6010	22%	22%	11%	17%	18%

The validated laboratory results of the confirmatory analysis and XRF analyses for both lead and arsenic were then evaluated with a least squares linear regression analysis, which provided a coefficient of determination (R^2) and slope. The following sections discuss the linear regression data correlation analysis results and the XRF data acceptability for both lead and arsenic.

Arsenic Data Correlation

Linear regression analysis between field XRF and laboratory results for arsenic from soil samples from the first removal assessment generated a final R^2 value of 0.9681 and slope value of 1.154. Based on the strong positive correlation of 0.9681 between XRF and laboratory results, the XRF data generated for arsenic concentrations during this assessment exceed the EPA criteria for use as screening level data (R^2=0.7). Based upon the calculated slope of 1.154, the XRF concentrations for arsenic are documented as exhibiting a low bias. Since the slope is within 20% of a 1:1 slope, the documented biases are acceptable and usable without adjustment. Linear regression analysis between field XRF and laboratory results for arsenic concentrations around the SSL of 60 mg/kg indicate that the correlation remains acceptable for use as screening level data (R^2=0.7737), but the slope increased to 1.2722. Such a slope suggests that to eliminate decision error, an action level of 60 mg/kg would need to be adjusted to 47 mg/kg if XRF arsenic data were used for final decision-making.

Linear regression analysis between field XRF and laboratory results for arsenic from soil samples from the second removal assessment generated a final R^2 value of 0.9923 and slope value of 1.0504. The concentration results from one sample with an extremely high concentration of arsenic were considered an outlier and were not used in the comparison. Based on the strong positive correlation of 0.9923 between XRF and laboratory results, the XRF data generated for arsenic concentrations during this assessment exceed the EPA criteria and are acceptable for use as screening level data (R^2=0.7). Based upon the calculated slope of 1.0504, the XRF concentrations for arsenic are documented as exhibiting a slightly low bias. Since the slope is within 20% of a 1:1 slope, the documented biases are acceptable and usable without adjustment.

Lead Data Correlation

Linear regression analysis between field XRF and laboratory results for lead samples submitted to the laboratory as part of the two removal assessments generated final R^2 values of 0.9908 and 0.9952 and slope values of 1.0798 and 1.1166. Based on the strong positive correlation between XRF and laboratory results, the XRF data generated for lead concentrations during these assessments exceed the EPA criteria for use as screening level data (R^2=0.7). Based upon the calculated slope, the XRF concentrations for lead are documented as exhibiting a slightly low bias. Since the slope is within 20% of a 1:1 slope, the documented biases are acceptable and usable without adjustment.

4.2 LEACHABILITY SAMPLING AND ANALYSIS

As part of the removal assessment conducted in May 2013, EPA analyzed composite soil samples from residential properties for extractable metals by two EPA leachate procedures, TCLP and SPLP. The extract was analyzed for the eight RCRA metals including arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury. The total and extractable concentrations for the three composite samples were all below the RCRA criteria. The lead and arsenic results are shown below. The residential soil leachate procedure sample analyses results for lead and arsenic are shown below in Table 7 and Table 8, respectively.

Table 7: Extractable Lead Results

Sample	Total Lead (mg/kg)	RCRA Lead Criteria (mg/L)	TCLP Lead (mg/L)	SPLP (mg/L)
Composite 1	1,300	5	0.35	0.38
Composite 2	12,000	5	1.4	1.5
Composite 3	3,100	5	1.0	0.79

Table 8: Extractable Arsenic Results

Sample	Total Arsenic (mg/kg)	RCRA Arsenic Criteria (mg/L)	TCLP Arsenic (mg/L)	SPLP (mg/L)
Composite 1	260	5	1.1	0.26
Composite 2	1,400	5	0.48	0.44
Composite 3	590	5	0.78	0.44

As part of the removal action in the summer of 2014, EPA evaluated samples from the ECS slag pile (north slag pile) and the RCS slag pile (south slag pile) for extractable metals using the TCLP and SPLP procedures. In addition, these samples were also evaluated for extractable metals using the MWMP test. For all three extractable metals analyses performed, slag material samples exceeded, to varying degrees, the benchmarks for lead and arsenic. The slag material leachate procedure sample analyses results are shown below in Table 9.

Table 9: Summary of Leachability Data for Slag Pile Materials

Analyte or Parameter	Waste Criteria Benchmark or (MCL)*	North Slag Pile - Dark Slag	North Slag Pile - Med Slag	North Slag Pile - Light Slag	South Slag Pile
Total Metal (mg/kg)					
Lead	NA	15,000	11,000	23,000	34,000
Arsenic	NA	1,700	8,100	6,100	19,000
Mercury	NA	0.17	0.065J	1.1	1.6
Antimony	NA	330	300	180	2,200
Barium	NA	1,800	970	1,300	510
Beryllium	NA	1.2	0.81	1.5	0.51J
Cadmium	NA	10	2.8	69	24
Chromium	NA	12	15,000	12	4.7J
Cobalt	NA	ND	9.1	ND	ND
Iron	NA	250,000	220,000	200,000	170,000
Magnesium	NA	9,400	3,800	9,800	3,200
Manganese	NA	2,100	610	880	360
Molybdenum	NA	190	1,200	1,000	1,100
Nickel	NA	ND	ND	5.5	2,300
Selenium	NA	ND	ND	ND	ND
Silver	NA	28	20	48	57
Thallium	NA	710	ND	ND	5.2
Vanadium	NA	110	88	100	65
Zinc	NA	51,000	24,000	21,000	41
Toxicity Characteristic Leaching Procedure (TCLP)* Metals in mg/L					
Lead	5.0	17	37	53	270
Arsenic	5.0	1.4	36	5.0	26
Barium	100	4.0	1.4	2.0	0.22
Cadmium	1.0	ND	ND	0.44	ND
Chromium	5.0	ND	ND	ND	ND
Selenium	1.0	ND	ND	ND	ND
Silver	5.0	ND	ND	ND	ND
Mercury	0.2	ND	ND	ND	ND

Analyte or Parameter	Waste Criteria Benchmark or (MCL)*	North Slag Pile - Dark Slag	North Slag Pile - Med Slag	North Slag Pile - Light Slag	South Slag Pile
Synthetic Precipitation Leaching Procedure (SPLP)* Metals in mg/L					
Lead	(0.015)*	0.89J	1.4	1.1	1.8
Arsenic	(0.010)*	0.22J	1.8	0.7	0.75
Barium	(2.0)*	ND	ND	ND	ND
Cadmium	(0.002)*	ND	ND	ND	ND
Chromium	(.05)*	ND	ND	ND	ND
Selenium	(0.006)*	ND	ND	ND	ND
Silver	(0.1)*	ND	ND	ND	ND
Mercury	(0.002)*	0.00004J	0.00005J	0.00005J	0.00019J
Meteoric Water Mobility Procedure (MWMP)* Metals in mg/L					
Lead	(0.015)*	0.018	<0.0025	0.043	0.069
Arsenic	(0.010)*	0.037	0.44	0.82	2.3
Analyte or Parameter	Waste Criteria Benchmark or (MCL)*	North Slag Pile - Dark Slag	North Slag Pile - Med Slag	North Slag Pile - Light Slag	South Slag Pile
Antimony	(0.006)*	0.076	0.040	0.066	1.2
Barium	(2.0)*	0.097	0.031	0.072	0.029
Cadmium	(0.005)*	ND	ND	ND	ND
Chromium	(.05)*	ND	ND	ND	ND
Selenium	(0.05)*	ND	ND	ND	ND
Silver	(0.1)*	ND	ND	ND	ND
Mercury	(0.002)*	ND	ND	ND	ND
Aluminum	0.05	ND	ND	ND	0.048
Beryllium	(0.005)*	ND	ND	ND	ND
Cobalt	NA	ND	ND	ND	ND
Copper	(1.3)*	ND	ND	ND	ND
Molybdenum	NA	ND	0.086	0.12	0.13
Magnesium	NA	0.54	ND	1.3	0.89
Nickel	(1.3)*	ND	ND	ND	ND
Thallium	0.002	ND	ND	ND	ND
Vanadium	NA	ND	ND	ND	ND
Zinc	(5.0)*	0.59	0.032	0.035	0.024
Iron	(0.3)*	ND	ND	0.038	0.056
Hydroxide	NA	ND	ND	ND	ND
Bicarbonate	NA	16	10	53	48
Carbonate	NA	ND	ND	ND	ND
Total Alkalinity	NA	16	10	53	48
Total Dissolved Solids	(500)*	26	10	94	67
Total Nitrogen	(1)*	ND	ND	0.6	0.4
WAD Cyanide	(0.2)*	ND	ND	ND	ND

Analyte or Parameter	Waste Criteria Benchmark or (MCL)*	North Slag Pile - Dark Slag	North Slag Pile - Med Slag	North Slag Pile - Light Slag	South Slag Pile
Meteoric Water Mobility Procedure (MWMP)* Metals in mg/L (Continued)					
Chloride	(250)*	ND	ND	1.0	ND
Fluoride	(4.0)*	ND	ND	0.13	0.13
Sulfate	(250)*	5.9	1.7	18	3.6
Nitrates	(10)*	0.19	0.19	0.64	0.4
pH	6.5 - 8.5	7.31	7.11	8.19	8.08

Notes:
Bolded Value = Greater than benchmark
* = Values for reference only
J = Qualified as estimated
mg/kg = milligrams per kilogram
MCL = Maximum Contaminant Level
NA = No waste criteria for total metals
ND = Not detected
( )* = Value is the National Drinking Water MCL*, MCL goal, concentration based on either National Primary Drinking Water Regulations (NPDWRs or primary standards)* or National Secondary Drinking Water Regulations (NSDWRS or secondary standards)*
Source: E & E, 2014a

4.3 GEOTECHNICAL TESTING OF SLAG MATERIAL

As part of the removal action in the summer of 2014, EPA evaluated samples from the ECS slag pile (north slag pile) and the RCS slag pile (south slag pile). These were the same four samples submitted for leachability analyses (see previous section). Mechanical sieve analysis and hydrometer testing were conducted on these four samples. Results of these analyses are contained in a September 10, 2014 memorandum from Applied Soil Water Technologies.

As discussed in this memorandum, mechanical sieve and hydrometer results were plotted together and the calculated adjusted curve was also presented. The abrupt drop seen in the plotted curves is typical of soils with very few fines (minus 200 sieve). However, there was a significantly higher percentage of material from the light colored slag (ECS slag), as compared to the other samples, that passed through the 100 and 200 mesh sieves, indicating that this slag contains a higher percentage of fine grain material than the other slag material.

Table 10: Sieve Analyses, Percent Passing

Sieve Size	ECS Dark Slag	ECS Medium Slag	ECS Light Slag	RCS Slag
11/2”	100	100	100	100
1”	98.8	91.1	98.4	95.7
¾”	98.8	80.9	94.7	92.8
½”	93.1	64.6	89.2	85.2
3/8”	89.1	56.3	81.7	78.6
#4	63.3	33.8	54.9	56.6
#10	24.7	10.7	35.1	32.5
#16	13.7	5.1	28.9	21.9
#40	6.1	2.5	22.6	11.5
#100	3.9	1.8	18.4	7.1
#200	2.9	1.3	14.5	5.0

4.4 BIOAVAILABILITY AND BIOACCESSIBILITY SAMPLING

Bioavailability is the percentage of a contaminant that actually remains in the body after it is ingested. The rest of the contaminant is excreted. The lower the bioavailability, the lower the possible toxicity associated with that contaminant. Studies on soil lead and arsenic bioavailability fall into two general categories: (1) *in vitro* bioaccessibility (IVBA) studies and (2) *in vivo* bioavailability studies. IVBA studies attempt to predict bioavailability from measurements of the solubility of soil lead or arsenic when soil is exposed to fluids that closely approximate the chemical conditions of gastric and/or intestinal fluids. *In vivo* bioavailability studies directly measure absorption of lead or arsenic in live organisms exposed to soil. *In vivo* studies have been conducted on various organisms, including bacteria, plants, invertebrates, and mammals (e.g., human, swine, rats, and mice). A predictive relationship between soil lead bioaccessibility and *in vivo* bioavailability measured in swine was developed based on assays of soils impacted primarily by lead mining and smelting waste. However, this relationship has been verified only for lead and not arsenic.

In order to estimate the bioavailability percentage of lead and arsenic in soil samples collected from Eureka, a cross-section of 43 soil samples was selected and analyzed using bio-accessibility extraction procedure EPA 9200.2-86. Of the selected 43 soil samples, 65% were from residential properties, 26% were from vacant or undeveloped properties, 7% were from commercial properties, and 2% from the ECS (north) slag pile.

In addition to the bioaccessibility testing that was performed by the EPA Region 9 Laboratory, EPA shipped six Eureka soil samples to EPA’s Office of Research and Development (ORD) for bioavailability/bioaccessibility testing (Bradham 2014).

- Samples were also shipped to the EPA ORD for *in vivo* mouse assays and total arsenic analysis by Instrumental Neutron Activation Analysis (INAA) at North Carolina State University's Nuclear Reactor Program.
- Samples were also shipped to the EPA ORD for arsenic speciation, which was examined using the Materials Research Collaborative Access Team's beamline 10-ID, Sector 10 at the Advanced Photon Source, Argonne National Laboratory, Argonne, Illinois.

The results of the EPA ORD bioavailability/bioaccessibility testing are summarized in the following two tables.

Table 11: Total Soil Concentration and IVBA Data for Lead

Soil ID	Total [lead] (mg/kg) Reported by R9*	IVBA (%) ORD Lab, based on R9 totals*	IVBA (%) R9 Lab
115401-C	3,500	72	173
116101-C	7,800	77	77
113609-C	4,200	90	94
113603-C	3,400	90	85
111703-C	3,700	81	72
107403-C	4,000	81	87

*Extractable concentration based on EPA Method 3050

Table 12: Total Soil Concentration, IVBA, and *in vivo* Relative Bioaccessibility (RBA) Data for Arsenic

Soil ID	Total [arsenic] (mg/kg) *Using INAA*	Total [arsenic] (mg/kg) Reported by R9*	IVBA (%)ORD Lab, based on INAA totals	IVBA (%) R9 Lab*	RBA (%)
115401-C	648	730	36	91	13
116101-C	1589	1700	37	40	12
113609-C	774	750	44	55	15
113603-C	673	690	44	45	14
111703-C	735	730	40	46	15
107403-C	588	680	47	52	17

*Extractable concentration based on EPA Method 3050

In general there was good correlation between the EPA Region 9 and EPA ORD IVBA studies for lead. Eureka soils displayed an unusual discrepancy between arsenic *in vivo* bioavailability and IVBA results. Specifically, IVBA results were substantially higher (avg. 41 ± 4 % IVBA) than *in vivo* bioavailability values (avg. 14 ± 2 % RBA). The reasons for this discrepancy are not clearly understood, but may be related to higher levels of sodium and lower levels of aluminum, iron, and manganese. These levels may have affected the rate of arsenic solubilization and the systemic uptake of solubilized arsenic *in vivo*.

For purposes of the Streamlined Risk Assessment and for calculating soil cleanup levels, EPA has chosen to use the 95th percentile of the arsenic RBA data, which is 16.5%, and an average IVBA of 76% for lead.

4.5 BLOOD LEAD SAMPLING AND ANALYSIS

In July 2013, the Nevada State Health Division, in coordination with the Eureka County Health Clinic, conducted initial blood lead level testing using finger stick methodology. In January 2012, the Center for Disease Control issued a report on childhood blood lead poisoning. This report recommended that a reference value based on the 97.5th percentile of the blood lead level distribution in children 1-5 years old (currently 5 micrograms per deciliter of blood [µg/dL]) be used to identify children with elevated blood lead levels Center for Disease Control, 2012). Of the 158 people that participated in the initial testing, 101 live in Eureka and of these 101 participants, 10 were less than 5 years of age. Results showed 25 people with blood lead levels between 2 and 5 µg/dL, six people with blood lead levels between 5 and 10 µg/dL, and three people with lead levels greater than 10 µg/dL. Subsequently, EPA was informed that one of the individuals tested was a 4-year-old resident of Eureka who had a blood lead level of 9.9 µg/dL. Testing of soil at the residence showed contamination at 19,000 mg/kg lead. EPA immediately conducted a removal action at the property to mitigate exposure.

Subsequent to the initial blood lead testing, the Eureka County Health Clinic initiated blood lead testing under a grant administered by NDEP. For the quarter ending December 2013, five Eureka residents had blood lead levels measured. The results are presented in the table below.

Table 13: December 2013 Blood Lead Results

Age	Blood Lead Result (µg/dL)
9	3.8
6	5.8
3	8.8
4	10.3
1	3.5

µg/dL = micrograms lead per deciliter of blood

5. STREAMLINED RISK ASSESSMENT

5.1 INTRODUCTION

As part of this EE/CA, a Streamlined Risk Assessment (SRA) has been conducted to evaluate the current and future human health risks associated with contaminants present in soils within the Town of Eureka. The results of the SRA are used to evaluate whether a cleanup action is needed. The SRA provides the basis for taking actions and identifies the contaminants and exposure pathways that need to be addressed by the cleanup action.

An ecological risk assessment has not been performed at this Site since the risks to human health posed by site contamination are the Agency's primary focus at this time.

5.2 CONCEPTUAL SITE MODEL

Figure 12 presents the Conceptual Site Model (CSM), which forms the basis of the SRA. The primary exposure route identified in the CSM is ingestion of soil and dust at current and potential future residential properties. The majority of current and potential future residential properties within the Town of Eureka have elevated levels of lead and arsenic in soil. Limited indoor sampling at residential properties has shown the potential for indoor contamination as well. Ingestion of contaminated soil and dust is one of the primary routes of human intake of contaminated soil. Most people, especially children, ingest small amounts of soil that adhere to the hands or other objects. In addition, outdoor soil can enter the home and mix with indoor dust, which may be ingested during meals or hand-to-mouth activities. Conversely, the pathway of dermal contact with contaminated soil is likely to be minor in comparison to the amount of exposure that occurs by soil and dust ingestion. Inhalation exposure is also likely to be a very small source of risk compared to incidental ingestion of soil.

Exposure to soil contaminants via consumption of home-grown fruits and vegetables was not fully evaluated due to lack of site-specific data. However, the relatively short growing season, the limited number of observed vegetable gardens, and risk assessment modelling conducted at other similar sites suggest that ingestion of locally grown vegetables would provide a minor contribution to the overall risk.

Risk associated with consumption of home-grown fruits and vegetables could be minimized through an outreach program that emphasizes careful washing of home-grown fruits and vegetables to ensure that loose soils that may be clinging to the food are removed. This outreach program could also recommend smart gardening techniques, which suggest limited intake of vegetables that may accumulate more lead and arsenic from soil as compared to other plants. Such vegetables include lettuce, radishes, broccoli, brussel sprouts, kale and cabbage.

The CSM also identified ingestion of soil and dust at undeveloped portions of former mill and smelter sites as a significant exposure pathway. Lead and arsenic soil concentrations have been identified at these parcels in excess of 100,000 mg/kg and 32,000 mg/kg, respectively. These parcels are located within the Town limits, have residential properties in close proximity, and could conceivably be developed in the future as residential properties. Conversely, dermal contact with contaminated soil and inhalation exposure are deemed to be a small risk compared to ingestion of soil at undeveloped portions of former mill and smelter sites. Dust emanating from these parcels could also impact nearby residential properties.

The CSM also identified the slag piles as a potential exposure pathway. High levels of lead (in excess of 44,000 mg/kg) and arsenic (in excess 25,000 mg/kg) have been found in the slag material. Due to a lower percentage of fine-grained material present in the slag material, as compared to the percentage of fine-grained material present in residential soil and soil at former mill and smelter sites, the risk of exposure to slag material may be less than that associated with soil present at residential properties and former mill and smelter sites. However, given the high levels of lead and arsenic in the slag piles, the unrestricted access to the slag piles, and that slag material can be seen eroding onto nearby residential properties and into the Eureka Creek, ingestion of slag and associated dust is considered a potential exposure pathway.

The slag material may also present a threat to groundwater and drinking water resources. The slag material failed TCLP testing for lead and arsenic, indicating the possibility that these constituents could migrate to groundwater. There is not sufficient data to indicate whether migration of lead and arsenic from the slag piles to groundwater is occurring. This is not a currently complete pathway, as the shallow aquifer within Eureka is not used as a drinking water source. Current and potential drinking water sources are wells located in Diamond Valley and springs located hydraulically upgradient from the slag piles.

Exposure to sediment and surface water within Eureka Creek is also a potential exposure pathway. Sediment within the creek bed, particularly adjacent to and downstream from the slag piles, contains elevated levels of lead and arsenic. Surface water within the creek also exceeds drinking water standards. The creek splays out onto an alluvial fan north of Town. Within the Town limits, the stream bed is well vegetated and does not appear to receive recreational use or significant foot traffic. Surface water from the creek is used in a stock pond at a ranch at the northern end of Town, although no sampling data are available from this stock pond.

Lead and arsenic soil contamination also extends beyond the boundaries of Eureka onto privately-owned land that is part of a gold mine and onto land managed by the BLM. Access to the mine property is restricted. It is possible that there could be risk associated with recreational activities on the BLM managed property, but this is outside of the scope of the EE/CA.

5.3 HUMAN HEALTH RISK ASSESSMENT

A quantitative risk assessment was not performed as part of this EE/CA. Instead, the SRA relies upon qualitative assessment of risk that evaluates the CSM, identifies chemicals of potential concern, and compares site data to measured background levels and calculated cleanup goals.

5.3.1 Contaminants of Potential Concern

Based on information collected during the performance of the removal assessments, lead and arsenic have been identified as the contaminants of potential concern (COPCs) for soil. The COPCs were selected through an evaluation of detection frequencies, detection concentrations, comparison with background concentrations and a toxicity/concentration screening.

Since residents of Eureka receive their drinking water from a public drinking water source which is routinely tested for contaminants, COPCs were not identified for groundwater or drinking water.

5.3.2 Arsenic Risks

Non-cancer risks are described in terms of a Hazard Index (HI). The HI represents a ratio of the dose at the Site divided by a dose believed to be safe. An HI equal to or less than 1 indicates that there is no appreciable risk of non-cancer health effects occurring. Conversely, an HI greater than 1 indicates a possibility that non-cancer risks may occur, although an HI above 1 does not indicate an effect will definitely occur. However, the larger the HI value, the more likely it is that an adverse health effect may occur.

Cancer risks are described by the probability that an exposed individual will develop cancer due to exposure by age 70. EPA's risk management range for potential excess cancer risks is $1x10^{-4}$ to $1x10^{-6}$ (100 per million to 1 in one million). The maximum residential arsenic soil concentration is 32,000 mg/kg, which is associated with a $2x10^{-2}$ cancer risk and a HI of 116.

5.3.3 Lead Risks

Risks from lead are usually evaluated by estimating the blood lead levels in exposed individuals and comparing those levels to health-based guidelines. In the case of residential exposure, the population of chief concern is children under the age of 7 years. EPA has set a goal that there should be no more than a 5% chance that a child should have a blood lead value over 10 µg/dL.

The probability of exceeding a blood lead value of 10 µg/dL is referred to as P10. Blood lead levels in an exposed population of children may be measured either directly, or may be calculated using a mathematical model. Each of these approaches has strengths and weaknesses, so both of these approaches were used at the Site.

EPA's Integrated Exposure, Uptake and Biokinetic model was used to calculate site-specific soil cleanup levels based on the risks of lead exposure by children to lead in soil and dust at residential properties.

The maximum residential lead soil concentration is over 100,000 mg/kg, which exceeds the residential site-specific value (425 mg/kg) by more than a factor of 235 times and is clearly unacceptable.

5.3.4 Preliminary Remediation Goals and Tiered Response

The residential risk scenario, in conjunction with recommendations from the EPA Lead Handbook, was used to develop a tiered residential soil response for the Site. As discussed in the Handbook:

> *For early, interim actions, a tiered approach should be used for prioritizing cleanup actions. A tiered-response approach is recommended when sufficient resources are not available to fully address lead risks. The size and complexity of many lead sites often requires implementation of response actions over an extended period of time; therefore,*

it is often necessary to implement interim cleanup actions to manage short-term health risk concerns while response actions to address long-term risk are planned and implemented. Early Removal Actions at residential lead sites should contribute to the performance of the long-term permanent remedy.

Based on risk associated with exposure to lead and arsenic, EPA has identified the following tiered approach to residential soil in the Town of Eureka.

Table 14: Tiered Approach to Residential Soil

Tier	Lead Soil Concentration (mg/kg)	Arsenic Soil Concentration (mg/kg)
Tier 1	3,000	600
Tier 2	1,275	326
Tier 3	425	234

The Tier 1 lead and arsenic levels of 3,000 mg/kg and 600 mg/kg were identified based on consistency with the lead and arsenic removal action levels identified in the initial Action Memorandum for the Site.

The Tier 2 lead level of 1,275 mg/kg lead was based on the recommendations from the Lead Handbook (EPA 2003), which were then adjusted for site-specific conditions. Per the Handbook, "The 1,200 parts per million (ppm) concentration is not an action level for Time Critical Removal Actions (TCRAs), but is intended to provide an alternative to running the Integrated Exposure, Uptake and Biokinetic model if the project manager believes the site poses an urgent threat." The 1,200 ppm concentration was adjusted for a site-specific lead bioavailability factor which was determined to be 75%.

The Tier 2 arsenic level of 326 mg/kg was identified based on a non-carcinogenic HI equal to one, adjusted for a site-specific arsenic bioavailability factor which was determined to be 16.5% and for 270 days/year of exposure (3 months snow cover, plus 2 weeks of vacation).

The Tier 3 lead level of 425 mg/kg was based on the lead residential RSL of 400 mg/kg, adjusted for a site-specific lead bioavailability factor, which was determined to be 75%, and for 270 days/year of exposure (3 months snow cover, plus two weeks of vacation).

The Tier 3 arsenic level of 234 mg/kg was identified based on a $1x10^{-4}$ excess cancer risk, adjusted for a site-specific arsenic bioavailability factor which was determined to be 16.5% and for 270 days/year of exposure (3 months snow cover, plus 2 weeks of vacation).

The presence of sensitive populations (children up to 7-years-old or pregnant women), could be used to elevate any residential property up to the next highest tier.

6. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Applicable or relevant and appropriate requirements (ARARs) cover both federal and state environmental requirements and are used to: (1) evaluate the appropriate extent of Site cleanup; (2) scope and formulate alternatives; and (3) guide the implementation and operation of a selected action. Section 300.415(j) of the National Contingency Plan (NCP) requires that "removal actions pursuant to CERCLA Section 106, shall "to the extent practicable, considering the exigencies of the situation, attain ARARs under federal or state environmental or facility siting laws."

The EPA Region 9 requested and received ARARs from the State of Nevada for consideration in this EE/CA. For a state requirement to be an ARAR, it must be identified in a timely manner, as well as being promulgated, substantive, and more stringent than the federal ARAR.

6.1 TERMS AND DEFINITIONS

The following are explanations of the terms and definitions used throughout this ARARs discussion:

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 a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

Relevant and appropriate requirements are cleanup standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. A requirement must be determined to be both relevant and appropriate to be considered an ARAR.

Information to be considered (TBC) are non-promulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. They are considered in the absence of federal or state ARARs, or when such ARARs are not sufficiently protective. An example of information to be considered is the EPA Region 9 RSLs that provide guidance to assess human health implications during a removal action.

Under the description of ARARs set forth in the NCP, state and federal ARARs are categorized as:

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 an acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment.

Location-specific ARARs set restrictions on chemical concentrations or the conduct of activities solely because they are in special locations. Special locations may include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-specific ARARs set controls or restrictions on particular kinds of activities related to the management of particular wastes or materials. Selection of a particular response action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies as well as specific environmental levels for discharged or residual chemicals.

Identification and evaluation of ARARs is an iterative process that continues throughout the response process. As a better understanding is gained of site conditions, contaminants, and response alternatives, the lists of ARARs and their relevance to the removal action may change.

6.2 OTHER CONSIDERATIONS AND ASSUMPTIONS

Under the NCP (40 Code of Federal Regulations [CFR] § 300.415(j)) removal actions financed by the Superfund pursuant to Section 104 of CERCLA (42 United States Code [U.S.C.] § 9604) shall to the extent practicable, considering the exigencies of the situation, attain ARARs under federal or state environmental or facility siting laws. In determining what is practicable, EPA considers the urgency of the situation and the scope of the removal to be conducted.

6.3 ARARS AND TBCS

The following chemical- and location-specific ARARs and information TBC have been identified for the removal action alternatives being evaluated under this EE/CA:

Table 15: Chemical-Specific ARARs and TBCs

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	STATUS AND RATIONALE
Solid Waste	EPA Region 9 Site-Specific Cleanup Levels (based on adjusted residential Regional Screening Levels (November 2012)	TBC	Establishes health based screening levels for soils and other media	Use to determine Site-Specific Cleanup Levels for lead and arsenic in contaminated soils

TBC = To be considered

Table 16: Location-Specific ARARs

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	STATUS AND RATIONALE
Cultural Resources	FEDERAL The Native American Graves Protection And Repatriation Act – 25 U.S.C. § 3001 *et seq;* 43 CFR Part 10.	Applicable	Protects Native American graves from desecration through the removal and trafficking of human remains and cultural items including funerary and sacred objects.	Substantive requirements applicable if Native American burials or cultural items are identified within area to be disturbed.
Cultural Resources	FEDERAL National Historic Preservation Act – 16 U.S.C. § 470 *et seq;* 36 CFR Part 800	Applicable	Provides for the protection of sites with historic places and structures.	Substantive requirements applicable if eligible resources identified within area to be disturbed.
Cultural Resources	FEDERAL Archeological Resources Protection Act of 1979 – 16 U.S.C. § 470aa; 43 CFR Part 7	Applicable	Prohibits removal of or damage to archaeological resources unless by permit or exception.	Substantive requirements applicable if eligible resources are identified within area to be disturbed.
Archeological Resources	FEDERAL Archeological and Historic Preservation Act	Applicable	Establishes procedures for preservation of historical and archeological data that might be destroyed through alteration of terrain.	May be applicable if archeological data must be preserved as a result of the cleanup.
Endangered Species	FEDERAL **Endangered Species Act –** 16 U.S.C. §§1531-1548; Title 50 CFR Parts 17 and 402	Applicable	Regulates the protection of threatened and endangered species or critical habitat of such species.	Substantive requirements applicable if protected species are identified within area to be disturbed.
Flood Plains	FEDERAL Executive Order 11988	Applicable	Flood Plain Management	May apply if the flood plain is altered as a result of the cleanup.
Wetlands	FEDERAL Executive Order 11990	Applicable	Provides for protection of wetlands	May apply if wetlands are impacted by the cleanup.
Stream or river bed alteration	FEDERAL Fish and Wildlife Coordination Act – 16 U.S.C. § 661 *et seq.*	Applicable	Provides for protection of water bodies	May apply if the cleanup will impact streams or rivers; requires consultation with U.S. Fish & Wildlife Service.

CFR = Code of Federal Regulations
U.S.C. = United States Code

Table 17: Action-Specific ARARs

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	STATUS AND RATIONALE
Solid Waste	FEDERAL Resource Conservation and Recovery Act (RCRA) of 1976, as amended – 42 U.S.C. §§ 6901 *et seq*.; 40 CFR Part 264, Subpart N	Relevant and Appropriate	Regulates disposal of hazardous waste in landfills.	Substantive requirements may be relevant and appropriate to mining wastes, including slag. Lead slag is likely excluded as a hazardous waste under Bevill Amendment, but is still a hazardous substance under CERCLA.
Solid Waste	FEDERAL RCRA – 42 U.S.C. §6921(a)(3)(A)(ii); 40 CFR 261.4(7)	Applicable	Bevill Amendment: Exemption of certain mining wastes from RCRA Subtitle C hazardous waste requirements	Applies to slag from primary lead processing.
Solid Waste	NEVADA Solid Waste Management Systems – NAC §§ 444.6405, 444.641, 444.6415, 444.6419, 444.6426, 444.643, 444.6435, 444.644, 444.645, 444.658	Applicable	Provision applicable to solid waste management systems. May apply to construction of off-site landfill.	Substantive requirements may be applicable to wastes that are subject to the requirement.
Hazardous Materials	FEDERAL Hazardous Materials Transportation Law (formerly Hazardous Materials Transportation Act) – 49 CFR Parts 171, 172, 173	Applicable	Provides protection against the risks to life, property, and the environment that are inherent in transportation of hazardous materials in commerce.	Substantive requirements applicable to transportation of materials subject to the Act.
Storm Water	FEDERAL Clean Water Act (CWA) – 40 CFR § 122.26	Applicable	Establishes monitoring and pollutant control requirements for storm water from industrial activities	The substantive requirements would be applicable if construction activities associated with the response action will disturb an area of five acres or greater.
Surface Water	FEDERAL CWA – 33 U.S.C. § 1342; National Pollutant Discharge Elimination System (NPDES); 40 CFR parts 122, 125	Applicable	On-site and off-site discharges from site are required to meet the substantive CWA requirements, including discharge limitations, monitoring and best management practices.	Substantive requirements may be applicable.
Water	FEDERAL Section 404 of the CWA – 33 U.S.C. § 1344, 40 CFR 230 and 231. Dredge and Fill Permits	Applicable	Regulates discharge of dredged or fill material into waters of the U.S., including wetlands.	Substantive requirements may be applicable to activities impacting waters of the U.S.

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	STATUS AND RATIONALE
Water	NEVADA NAC § 445A.121 Standards Applicable to all Surface Waters; NAC § 445A.122 Standards Applicable to Beneficial Uses	Applicable	Identifies standards that are applicable to all surface waters of the State. Identifies standards intended to protect both existing and designated beneficial uses.	Substantive standards may apply to impacted surface waters.
Air	NEVADA NAC § 445B.22037 Emissions of particulate matter: Fugitive dust.	Applicable	Regulates the generation of particulate matter associated with the handling, transporting or storing of material.	Substantive requirements may be applicable to activities associated with handling, transporting or storing of soil.

CERCLA = Comprehensive Environmental Response, Compensation and Liability Act
CFR = Code of Federal Regulations
NAC = Nevada Administrative Code
U.S.C. = United States Code

7. IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

7.1 DEVELOPMENT OF REMOVAL ACTION OBJECTIVES

This section identifies Removal Action Objectives (RAOs) for the Site. The overall purpose for undertaking a removal action and selecting one or more removal action alternatives is to address human health and environmental concerns at the Eureka Site. The following RAOs have been identified for the Eureka Site:

- Reduce or eliminate the potential for exposure via direct contact, ingestion, or inhalation by human receptors to lead and arsenic present in residential soil. Residential properties are defined as any area with high accessibility to sensitive populations, and include properties containing single- and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, day-care centers, community centers, playgrounds, parks, green ways, and any other areas where children may be exposed to site-related contamination media.
- Reduce or eliminate the potential for exposure via direct contact, ingestion, or inhalation by human receptors to lead and arsenic present in the interior of residential properties.
- Reduce or eliminate the potential for lead and arsenic to migrate from source areas (slag piles and former mill and smelter sites) via wind transport, runoff, and erosion.
- Reduce or eliminate the potential for lead and arsenic to migrate via wind transport, surface runoff, and erosion from undeveloped land that may be contaminated.
- Reduce or eliminate the potential for future exposure via direct contact, ingestion, or inhalation of human receptors to lead and arsenic present in soil at currently undeveloped contaminated land that may be developed as residential land in the future.
- Reduce or eliminate the potential for exposure via direct contact, ingestion, or inhalation of human receptors to lead and arsenic present in soil at undeveloped contaminated land that could occur due to recreational use.
- Reduce or eliminate the potential human-health risks from direct contact with sediment or surface water, and potential risks to the riparian ecosystem.
- Conduct assessment and cleanup activities that are nationally consistent with other actions performed at similar sites across the country.

In addition to the RAOs, EPA has a strong preference for the selection of removal action alternatives which minimize the need for long-term operation, maintenance, and monitoring.

7.2 NATIONAL CONSISTENCY

The following information is excerpted from the EPA Handbook (2003).

- The Handbook was developed to promote a nationally consistent decision-making process for assessing and managing risks associated with lead-contaminated residential sites across the country.

- The Handbook lays out only minimum considerations for addressing lead-contaminated residential sites and encourages users to refer to appropriate Agency guidance and/or policy to conduct more stringent investigation and cleanup activities on a site-specific basis, if necessary.
- Residential properties are defined in the Handbook as any area with high accessibility to sensitive populations, and include properties containing single- and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, day-care centers, community centers, playgrounds, parks, green ways, and any other areas where children may be exposed to site-related contamination media.
- Lead-contaminated residential sites are defined as sites where lead is the primary COC in residential soils. Generally, lead-contaminated sites contain other metals of concern, such as cadmium and arsenic. This document, while addressing primarily lead contamination, may also be appropriate for use in remediation of sites contaminated by other metals.
- Several studies have shown that a significant short-term reduction in blood lead concentrations can be achieved through the education of the public on the dangers of lead exposure and on methods they can take to limit their exposure. However, EPA does not consider health education, as the only action, to be an effective, permanent remedy for Superfund sites.
- Delineating the zone of contamination generally amounts to distinguishing soil with "background" lead concentrations from soil that has been impacted by site-related activities. There are basically two types of background: naturally occurring and anthropogenic. EPA guidance defines background for inorganics as the concentration for inorganics found in soils or sediments surrounding a waste site, but which are not influenced by site activities or releases.
- The following section provides a detailed discussion of minimum considerations to remediate residential soil and other sources of lead in residential settings. The guidelines stated below apply to early/interim actions and long-term remedial actions. However, due to statutory funding limitations that apply to TCRAs, site-specific determinations regarding yard size limitations, including whether to clean up empty lots and other sources of lead (paint, dust, tap water), should be made by the project manager on a site-by-site basis.
  - Based on Agency experience, it is strongly recommend that a minimum of 12 inches of clean soil be used to establish an adequate barrier from contaminated soil in a residential yard for the protection of human health. Cover soil can either be placed after excavation as backfill or placed on top of the contaminated yard soil. The rationale for establishing a minimum cover thickness of 12 inches is that the top 12 inches of soil in a residential yard can be considered available for direct human contact. With the exception of gardening, the typical activities of children and adults in residential properties do not extend below a 12-inch depth. Thus the placement of at least 12 inches of clean soil will generally prevent direct human contact and exposure to contamination at depth.

- Removal of lead-contaminated soil to depths greater than 12 inches should be considered at sites in cold regions with non-soil lead contamination sources, such as tailings and crushed battery casings, whenever it is cost-effective.
- Twenty-four inches of clean soil cover is generally considered to be adequate for gardening areas.

- Currently, there are only two remedial options that generally are considered to be protective, long-term (not interim) remedial actions at residential properties: (1) excavation of contaminated soil followed by the placement of a cover barrier and (2) placement of a cover barrier without any excavation of contaminated soils. Excavation followed by the placement of a cover is the preferred method and is strongly recommended at sites with relatively shallow contamination, such as many smelter sites. In most cases, excavation and placement of a soil cover should be performed whenever the specific conditions of a site do not preclude it. For example, it may not be feasible to fully excavate a very large site cost-effectively; therefore, capping (also considered to be protective) may be more appropriate. Moreover, cover systems may facilitate grading and drainage objectives.
- Several treatment technologies are currently under development to reduce the bioavailability of lead in soil, but have not yet proven to be protective in the long-term. These include amending the soil with phosphorous or bio-solid composts with high iron content.
- The area remediated on a single property normally should not exceed one acre. This limitation is based on three factors: (1) typical lot sizes in residential areas throughout the country generally do not exceed one acre; (2) the portion of a property where the majority of exposure to contaminated soil occurs generally does not exceed one acre; and (3) EPA should generally not excavate/cover with soil the entirety of very large yards due to cost-effectiveness considerations.
- If contaminated soil is not removed to the full depth of contamination (i.e., where soil concentration is greater than cleanup level) on a property, a permanent barrier/marker that is permeable, easily visible and not prone to frost heave, should be placed to separate the clean fill from the contamination. This applies to both incomplete vertical excavation with placement of a soil cover, and placement of a soil cover without excavating contaminated soil.
- Empty lots that are zoned residential and contain soils with lead concentrations greater than the cleanup level should be cleaned up when in close proximity to other residential lots.

7.3 STATUTORY LIMITS ON REMOVAL ACTIONS

On July 30, 2013, EPA signed a time-critical Action Memorandum with a total extramural ceiling of $1,950,000. On April 9, 2014, EPA signed a time-critical Ceiling Increase Action Memorandum bringing the total extramural ceiling to $4,110,000. Subject to exemptions, 42 U.S.C. Section 9604(c)(1) limits the cost of a Removal Action to $2,000,000 and 12 months. As documented in the Ceiling Increase Action Memorandum, pursuant to EPA delegations 14-2 and R9 1290.03A, the Regional Administrator authorized an exception to the $2,000,000 statutory limit, as long as the costs did not exceed $6,000,000.

On June 12, 2015, EPA signed a project Ceiling Increase Action Memo, which also approved an exemption from the 12-month statutory limit to continue the removal action at the Eureka Smelters Site (aka Town of Eureka Site).

Work proposed under this EE/CA would exceed the ceiling of $6,000,000 that is authorized under Regional Removal authority and would require funding from outside the Regional Removal Allowance.

7.4 DETERMINATION OF REMOVAL SCOPE

This non-time critical removal action is intended to address imminent and substantial threats to the environment, but where a planning period of 6 months exists. Historically, the State of Nevada has opposed placing sites on the National Priorities List (NPL). The goal of the EE/CA is to identify a range of removal alternatives, including alternatives that could be considered a final remedy for this Site.

As identified previously, the Town of Eureka consists of approximately 480 acres of land (see Figure 1) that is completely surrounded by BLM-managed land. The overwhelming majority of the acreage within Eureka contains elevated levels of lead and arsenic in soil. As depicted in the lead and arsenic isoconcentration maps (Figures 10 and 11), the area of lead and arsenic soil contamination extends beyond the Town limits onto the BLM-administered land. Since this BLM-administered land is under the control of a federal resource agency, and is not likely to be used as residential or commercial properties without separate review by the BLM, the lead and arsenic impacted areas of the surrounding BLM-managed land are not considered as part of the project area being evaluated under this EE/CA.

For purposes of this EE/CA, the project area is considered to be any areas within the Town of Eureka that have lead or arsenic concentrations that exceed three times background levels. EPA has identified a lead background level of 50 mg/kg and an arsenic background level of 20 mg/kg. Based on these parameters, the EE/CA project area is identified on Figures 13 through 16. The boundaries of the project area could change slightly depending on additional sampling performed.

7.5 DETERMINATION OF REMOVAL SCHEDULE

Depending on the timing of the approval of this EE/CA, the selected alternative and the availability of funding, it is anticipated that work under this EE/CA would be initiated as soon as funding becomes available and as soon as the weather permits mobilization to the Site. Again, depending on the selected alternatives and the availability of funding, it is anticipated that work would need to occur over several field seasons. The construction season in Eureka typically runs from April through October.

7.6 PLANNED REMEDIAL ACTIVITIES

Currently there are no planned remedial activities. Historically, the State of Nevada has opposed placing sites on the NPL. The goal of the EE/CA is to identify a range of removal alternatives, including alternatives that could be considered a final remedy for the Site.

8. IDENTIFICATION AND ANALYSIS OF REMOVAL AND DISPOSAL ACTION ALTERNATIVES

In order to simplify the identification and analysis of removal and disposal action alternatives, EPA has chosen to define specific Operable Units (OUs) at the Site. These OUs are defined as specific geographic areas at the Site, with specific site problems, where a specific action is required. As part of this EE/CA, EPA will conduct a separate analysis of Removal and Disposal Action Alternatives for each identified OU. EPA has identified the following OUs at the Site:

- OU-1 Residential Properties
- OU-2 Consolidated Slag Piles
- OU-3 Undeveloped Parcels Within or Adjacent to Former Smelter and Mill Sites
- OU-4 Eureka Creek
- OU-5 Contaminated Material Disposal

The following sections describe each identified OU, and discuss both the Removal Alternatives and Disposal Alternatives evaluated as part of this EE/CA. As previously discussed, groundwater is not considered an OU since drinking water wells are no longer permissible within the Town of Eureka, municipal wells serving the residents are located at least 1.0 mile from the Site, and springs used for drinking water sources are upgradient from the Town of Eureka.

The estimated cost to implement each alternative was developed using vendor quotes, engineering estimates, and published cost data for heavy construction (RS Means 2013). Supporting cost data are included as Appendix B. The various alternatives for each OU are evaluated and compared in Section 9.

8.1 OU-1 RESIDENTIAL PROPERTIES

A residential property is defined by the EPA Handbook as any area with high accessibility to sensitive populations, and includes properties containing single- and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, day-care centers, community centers, playgrounds, parks, green ways, and any other areas where children may be exposed to site-related contaminated media.

Based on the SRA data collected as part of this EE/CA, site-specific bioavailability data, and EPA guidance and policy documents, the EPA has identified the following OU-1 Residential site-specific cleanup levels and associated prioritization tiers:

Tier I – Consists of residential properties containing soil lead concentrations greater than 3,000 mg/kg or soil arsenic concentrations greater than 600 mg/kg. In addition, Tier 1 residential properties would also include any Tier 2 residential properties where a pregnant woman is living, where children under 6 years of age are living, or where a resident has had a blood lead concentration in excess of 5 µg/dL.

Tier II – Consists of residential properties containing soil lead concentrations between 1,275 mg/kg and 3,000 mg/kg, or arsenic soil concentrations between 326 mg/kg and 600 mg/kg.

Tier III – Consists of residential properties containing soil lead concentrations between 425 mg/kg and 1,275 mg/kg, or arsenic soil concentrations between 234 mg/kg and 326 mg/kg.

The following table identifies the current total number of expected OU-1 properties based on sampling data, the current number of projected OU-1 properties, and the associated volumes within each of the three tiers. Prioritization tiers for those properties that were not directly sampled are based on evaluations of isoconcentration contour maps created using sampling data from nearby properties and commercially available contouring software (ESRI ArcGIS v 10.1, Inverse Distance Weighted Interpolation). The OU-1 properties are shown on Figure 13.

Table 18: Summary of OU-1 Residential Property Tiers

Tier Level	Number of Known Properties	Number of Projected Properties	Total Tier Properties	Total Estimated Volume of Waste (CY)[1]
TIER I	23	27	50	12,500
TIER II	38	82	120	30,000
TIER III	31	26	57	7,125
TOTALS	92	135	227	60,200

CY = cubic yards

1. Volume total includes the approximately 10,600 CY already excavated and stored in a temporary stockpile.

8.1.1 Assumptions Common to All Actionable OU-1 Alternatives

Except for the No Action alternative, the following assumptions are considered common to all alternatives evaluated for OU-1.

- The existing 10,600 CY stockpile is assumed to be part of the volume of contaminated soil requiring disposal and the cost to dispose of this soil is included as part of the evaluation of OU-5.
- In accordance with EPA Handbook guidance, in select areas such as vegetable gardens or children’s play areas, an additional 1 foot of soil may be excavated.
- Soils would not be excavated from beneath permanent structures such as houses, or semi-permanent structures such as rock walls, storage sheds, or gravel driveways.
- Institutional Controls (ICs) and education and outreach program are proposed. For OU-1 properties, these programs are described as follows:

ICs would generally be implemented by Eureka County and the NDEP. These ICs and the manner in which they would be implemented are described in the Draft Institutional Control Planning Document, which is attached as Appendix C. As described in this document:

"The final Institutional Control Plan (ICP) will be a locally controlled and maintained plan with an element of enforcement by NDEP designed to ensure the integrity of clean soil and other protective barriers placed over contaminants left in place throughout the Site. The ICP will include one set of activities and controls to guide grading activities, excavation work and other construction activities on all properties where barriers and caps have been installed and describe another set of activities designed to address areas where cleanup actions were not completed, but may contain elevated concentrations of lead and arsenic based on the property's proximity to source areas (slag piles) and location on concentration trend maps created for the Site. The ICP will also describe services and resources for current and future landowners and residents in the County, including education and outreach, technical assistance on soil sampling methods and requirements, clean replacement soil for small residential projects, and a permanent disposal site for contaminated soils generated Site wide."

To the extent that the ICs implemented by Eureka County and NDEP are not able to ensure the long-term integrity of the cleanup actions, or where property owners (particularly those living on or in close proximity to source areas) do not comply with the ICs, EPA would reserve the right to negotiate directly with those property owners regarding the implementation of ICs, or to take appropriate enforcement actions as necessary.

Sections 8.1.2 through 8.1.4 below describe the various Removal Alternatives evaluated for OU-1 (Figure 13).

8.1.2 OU-1 Removal Alternative 1 – No Action

Under the No Action alternative, no additional sampling or removal actions would occur and no additional direct costs would be incurred. Residential properties identified within OU-1 may continue to act as ongoing sources of contamination via exposure routes that include fugitive dust, contaminated surface runoff, and direct contact pathways.

8.1.3 OU-1 Removal Alternative 2 – Soil Removal and Capping at Tier I and Tier II Properties; ICs; and Outreach and Education Programs

Currently there is an estimated total of 42,500 CY of contaminated soil located on 170 Tier I and Tier II residential properties (known and projected) within OU-1. Under this alternative the contaminated soil from both Tier I and Tier II properties would generally be excavated to a depth of 1 foot bgs, and covered with 1 foot of imported clean fill material(s) (e.g., soil, humus, sod, rock). The disturbed areas would be landscaped. This alternative would require the excavation and disposal of approximately 42,500 CY of contaminated soil and would require approximately 42,500 CY of imported clean fill material(s) at Tier I and Tier II properties. No soil removal would occur on Tier III properties; however, ICs as described in Section 8.1.1 would be implemented.

8.1.4 OU-1 Removal Alternative 3 – Soil Removal and Capping at Tier I, Tier II, and Tier III Properties; ICs; and Outreach and Education Programs

Under this alternative an estimated 49,625 CY of contaminated soil would generally be excavated to a depth of 1 foot bgs at the 227 Tier I, Tier II, and Tier III properties. Excavated areas would be covered with 1 foot of imported clean fill material(s) (e.g., soil, humus, sod, rock). Using this alternative would require the excavation of approximately 49,625 CY of contaminated soil and would require approximately 49,625 CY of imported clean fill material(s). However, including the existing 10,600 CY stockpile of contaminated soil, the total disposal volume of residential soil would be 60,200 CY if this alternative were executed.

8.2 OU-2 SLAG PILES

Currently the EPA has designated OU-2 as four individual slag piles at the Site. The four slag pile locations are shown on Figure 14. These slag piles require special consideration due to their public accessibility, historic value as a cultural resource related to the area's mining history, and elevated contaminant concentrations. The elevated lead and arsenic concentrations at the slag piles suggest they are ongoing contaminant sources through wind-borne or water-borne entrainment of fine particles. The following table identifies each slag pile and the estimated volume(s).

Table 19: Summary of Slag Pile Volumes and Areal Extents

OU-2 Slag Pile	Footprint Area (acres)	Estimated Slag Waste Volume (CY)	*Estimated Volume of 2-Foot Soil Layer Beneath Slag (CY)	Total Waste Volume (CY)
ECS Slag Pile	3.25	18,400	10,500	28,900
RCS Slag Pile	2.87	38,200	9,300	47,500
Matamoras Consolidated Smelter Slag Pile	0.04	800	130	930
Atlas Consolidated Smelter Slag Pile	0.28	3,500	900	4,400
TOTALS	6.44	60,900	20,830	81,700

Notes:
CY = cubic yards
* = Estimated volume of 2-foot soil layer beneath slag material is assumed to be non-hazardous for waste disposal purposes
Volumes rounded to the nearest hundred cubic yard increment

The RCS and ECS slag piles are located near or adjacent to Eureka Creek, which flows south to north through the Town of Eureka. A smaller tributary to Eureka Creek abuts the southern side of the Eureka slag pile. Currently, Eureka Creek is actively eroding the western side of the RCS slag pile, and both slag piles are likely ongoing sources of contaminants to the creek. Under any OU-2 Removal Alternative, except the No Action alternative, it was assumed that some repair, restoration, and/or other creek bank stabilization measures would be needed as part of the removal action.

Based on current survey data, portions of the ECS slag pile extend into the right-of-way of State Highway 50, which is adjacent to the western portion of the slag pile. A domestic water supply pipeline and a fiber optic cable are present under and near the ECS slag pile. Based on conversations with the utility company that owns the fiber optic line (T. Dunkelman, Pers. Communication, 2013), the fiber optic cable is buried approximately 18 feet below the slag pile and therefore it was assumed that the cable would not need to be relocated or otherwise addressed prior to implementing any alternative that involved the ECS slag pile. This would require further verification with the owner of the fiber optic cable. The depth of the water line is unclear and further consultation with the local water agency would be required prior to implementing intrusive Removal Actions at the ECS slag pile.

Residential properties are located adjacent to the eastern and southern portions of the Atlas Smelter slag pile. Lead and arsenic were detected at concentrations up to 20,000 mg/kg and 6,900 mg/kg, respectively, in soil samples collected from 6-12 inches bgs at these properties. The observed nature and distribution of contaminants in soil samples collected from this area suggest that the Atlas slag pile and former Hoosac and Atlas Smelters were the sources of contaminants at the adjacent residential properties. A motel is located adjacent to the eastern portion of the Matamoras slag pile and numerous residential or commercial properties are located north and west of the slag pile.

8.2.1 Assumptions Common to All Actionable OU-2 Alternatives

Except for the OU-2 No Action alternative, the following assumptions were common to alternatives considered for OU-2.

- It was assumed that repair, rip rap, restoration, and/or other creek bank stabilization measures would be needed as part of any removal or remedial actions that involved grading, excavating, or capping of the slag piles.
- Based on composite samples collected from slag materials and analyzed using TCLP laboratory analytical methods, the slag pile wastes exceed the federal hazardous waste action levels for lead and arsenic, and would be classified as hazardous waste for disposal purposes. However, for the cost and volume estimates in this EE/CA, the 2-foot soil layer beneath slag pile wastes, which may potentially require excavation, was assumed to be non-hazardous material for disposal purposes.
- It was assumed that an inspection and maintenance program would need to be implemented to ensure that the cap functions as intended and to perform routine maintenance of erosion control measures (e.g., maintaining vegetation, checking surface drainages, etc.). Except for OU-2 Alternative 2, Removal of Slag Materials to an Existing Landfill, the maintenance programs were assumed to last for a period of 30 years.
- It was assumed that mitigation would have to be performed to offset the loss of historic features associated with remediation of the slag piles. Specific types of mitigation would be developed during the design phase of the project and could include, but are not limited to: documentation of existing historic features; development and construction of a historic display related to the slag piles or smelters; and preservation of some features associated with the slag piles.
- Several of the OU-2 Alternatives involve grading and covering of the slag piles.
  - EPA recognizes the potential for invasive plant species to re-occupy the disturbed land. Any work implemented on OU-2 land parcels would consider the potential for re-occupation of disturbed land by invasive plant species, and measures would be

taken to minimize this concern. Specific approaches to minimize invasive plant species on disturbed land would be developed during the design phase of the project.

- Any work implemented on OU-2 land parcels would consider the aesthetic features of the finished product. To the extent practical, during the design phase of the project, EPA would develop approaches that would make the disturbed land areas more aesthetically attractive. Examples of such approaches could include, but are not limited to: varying coloration of rocked areas; incorporating larger rocks or other features into rocked areas; and incorporating vegetated areas into rocked areas.

It is recommended that ICs be implemented under OU-2 Removal Alternatives 2 through 5. The ICs for each removal alternative (described below) would generally include guidelines or requirements on excavation work or any other type of development that may damage cap materials. However, it is anticipated that limited open space uses, such as a park or parking lot may be permissible after a site is stabilized. ICs would be recommended at properties where slag material is removed and/or capped, or where contaminated soils remain above the established cleanup levels. These ICs would typically restrict the property owners from performing any intrusive soil excavation work without performing additional measures. The IC program would be implemented in the same manner as described for OU-1. Sections 8.2.2 through 8.2.6 describe the various removal alternatives evaluated for OU-2.

8.2.2 OU-2 Removal Alternative 1 – No Action

Under the No Action alternative, no additional work or removal actions would occur, the slag piles would remain at their current locations, and no additional direct costs would be incurred. Slag materials would continue to act as ongoing sources of contamination via exposure routes that include fugitive dust, contaminated surface runoff, and direct contact pathways. Portions of the RCS and ECS slag piles would continue to erode into the drainages adjacent to them.

8.2.3 OU-2 Removal Alternative 2 – Removal of Slag Piles to an Existing Landfill; and ICs

If this alternative is implemented, slag materials and an assumed 2-foot-thick layer of underlying contaminated soils would be excavated and hauled to a hazardous waste landfill. Based on proximity and cost, it is currently assumed that the waste would be hauled to the U.S. Ecology facility in Beatty, Nevada. Based on current sampling data, leachate concentrations emanating from the waste exceed the federal limits for hazardous waste, and therefore the slag wastes are subject to Land Disposal Restrictions (LDRs). Based on conversations with the disposal facility (B. Milton Pers. Comm., 2015), the slag would need to be crushed to a particle size of 1 inch or less prior to stabilization.

For the purposes of volume and cost estimates, it was assumed that the excavation would cease when contaminants are removed below the OU-1 Tier III cleanup levels or when the excavation reaches 2 feet below the surrounding grade. Clean fill material would be imported as necessary to establish grades and surface water drainage patterns. It is assumed creek bank stabilization and repair would be necessary in Eureka Creek adjacent to the RCS and ECS slag piles.

8.2.4 OU-2 Removal Alternative 3 – Consolidation, Grading, and In-Place Capping of Slag Piles with a 2-Foot Soil Cover; and ICs

If this alternative is implemented, no excavation and disposal of contaminated material would occur. Slag at each slag pile site would be used to fill in existing holes, voids, and low-lying areas, and to reduce slope angles in available areas where existing slopes are steeper than approximately 3:1 horizontal to vertical slope ratio (H:V). For costing purposes it was assumed that a total of 10,000 CY of slag would need to be moved or re-graded within the Site.

After grading and placement of the imported wastes, the slag pile(s) would then be capped in-place using either 2 feet of compacted clean fill material, or a high density polyethylene (HDPE) geomembrane liner and 2 feet of compacted clean fill material. Clean fill would be imported as necessary to establish grades and surface water drainage patterns. Portions of the drainages adjacent to each slag pile would need to be excavated, armored with rip-rap (boulders), and otherwise stabilized to reduce erosion. It may also be desirable to line portions of the pile adjacent to the creeks, or portions of the creeks, with an HDPE liner to limit or prevent impacts to surface water and/or the scouring of fine soil materials that could lead to erosion of the caps. Depending on the methods used to cap the slag piles (the anticipated cap thicknesses range from 2-4 feet), the final elevation of each slag pile would be expected to increase between 1-5 feet.

8.2.5 OU-2 Removal Alternative 4 – Limited Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with a 2-Foot Soil Cover; and ICs

If this alternative is implemented, a limited volume of contaminated wastes (approximately 5,000 CY), likely generated from the Matamoras or Atlas Slag Piles, would be used to fill in existing holes, voids, and low-lying areas, and to reduce slope angles in available areas where existing slopes are steeper than approximately 3:1 H:V at the RCS and/or ECS slag pile(s). Following disposal of waste generated from the Site onto the utilized slag pile(s), the slag pile(s) would be graded such that the slopes are less than 3:1 H:V in all areas. For costing purposes it was assumed that approximately 5,000 CY of contaminated waste generated from other areas of the Site would be imported to the RCS and/or ECS slag pile(s). The actual volume is dependent on the method and actual slag pile(s) selected for transport and or capping; however, this is not expected to significantly affect the cost or length of the project.

After grading and placement of the imported wastes, the slag pile(s) would then be capped in-place using either 2 feet of compacted clean fill material, or a HDPE geomembrane liner and 2 feet of compacted clean fill material. Clean fill would be imported as necessary to establish grades and surface water drainage patterns. Additionally, if either the RCS or ECS slag piles are graded and capped in-place, it was assumed that portions of the drainages adjacent to each slag pile would need to be excavated, armored with rip rap (large boulders), and otherwise stabilized to prevent further erosion. It may also be desirable to line portions of the pile adjacent to the creeks, or portions of the creeks, with an HDPE liner to limit or prevent impacts to surface water and/or the scouring of fine soil materials that could lead to erosion of the cap. Depending on the method used to cap the slag pile(s) (anticipated cap thicknesses range from 2-4 feet), the final elevation of each slag pile would be expected to increase by a minimum of 1-5 feet.

8.2.6 OU-2 Removal Alternative 5 – Maximized Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with a 2-Foot Soil Cover; and ICs

Preliminary calculations performed in conjunction with the preparation of this EE/CA indicate that approximately 26,000 CY of contaminated waste could be placed onto the RCS and ECS slag piles (ASC 2015). Based on these estimates, if this alternative is implemented, approximately 26,000 CY of contaminated wastes generated from OU-1, OU-2, OU-3, and/or OU-4 would be used to fill in existing holes, voids, and low-lying areas, and to reduce slope angles in available areas where existing slopes are steeper than approximately 3:1 H:V at the RCS and/or ECS slag pile(s). The remaining wastes would be placed on the top or sides of the graded piles based on available area and standard engineering practices. The slag pile(s) would be graded such that the slopes are less than 3:1 H:V in all areas. The actual volume is dependent on the method and actual slag pile(s) selected for capping; however, this is not expected to significantly affect the cost or length of the project.

After grading and placement of the imported wastes, the slag pile(s) would then be capped in-place using either 2 feet of compacted clean fill material, or an HDPE geomembrane liner and 2 feet of compacted clean fill material. Clean fill would be imported as necessary to establish grades and surface water drainage patterns. It was assumed that portions of the drainages adjacent to the RCS and ECS slag piles would need to be excavated, armored with rip rap, and otherwise stabilized to reduce the potential for erosion. It may also be desirable to line portions of the pile adjacent to the creeks, or portions of the creeks, with an HDPE liner to limit or prevent impacts to surface water and/or the scouring of fine soil materials that could lead to erosion of the cap. Depending on the method used to cap the slag pile(s) (anticipated cap thicknesses range from 2-4 feet), the final elevation of each slag pile would be expected to increase by a minimum of 5-15 feet.

8.3 OU-3 UNDEVELOPED PARCELS WITHIN OR ADJACENT TO FORMER SMELTER AND MILL SITES

Currently the EPA has identified OU-3 as four individual undeveloped parcels totaling 20.62 acres within or adjacent to the footprints of former smelter and mill sites. The individual OU-3 parcels are shown on Figure 15 and identified as Hillside No.1, Hillside No. 2, Hillside No. 3, and Hillside No. 4. These parcels require special consideration due to their relatively steep slopes, common recreational usage, public accessibility, and relatively high contaminant concentrations that suggest these parcels may be ongoing contaminant sources through potential wind-borne entrainment of fine particles or runoff that are impacted by lead and arsenic. An approximate 4.0-acre portion of Hillside No. 2 is relatively flat and suitable for residential development. Therefore, although this area is in OU-3, remedies proposed for this sub-area are identical to those proposed for other residential properties (i.e., excavate 1 foot of clean fill and cap with imported materials).

Based on risk assessment data performed as part of this EE/CA, site-specific bioavailability data, and EPA guidance and policy documents, the following table identifies the area of concern at each OU-3 location.

Table 20: Summary of OU-3 Areal Extents

OU-3 Location	Total Area (acres)	Total Area (square feet)
Hillside No. 1	0.61	26,369
Hillside No. 2	3.56	154,896
Hillside No. 3	10.19	443,966
Hillside No. 4	6.26	272,586
TOTAL AREA	**20.62**	**897,817**
Total Volume for Disposal Assuming 1 Foot Deep Excavation		**33,250 CY**

Notes:
CY = cubic yards
sq. ft. = square feet

8.3.1 Assumptions Common to All Actionable OU-3 Alternatives

Except for the OU-3 No Action alternative, the following assumptions were common to alternatives considered for OU-3.

- The proposed remedy for the sloped areas is based on the *Ecology and Environment, Inc. Analysis of Proposed Rock Cap on Steep Slopes in the Town of Eureka, Eureka County, Nevada* (E & E 2014b). Four- to 8-inch crushed rock with a mean stone size of 6 inches was proposed as a rock mulch that would prevent direct contact and limit fugitive dust emissions. Based on the *New York Department of Environmental Conservation Standard Specifications for Riprap Slope Protection* (NYDEC Standards), the minimum rock layer thickness should be 1.5 times the maximum stone diameter, which in this case corresponds to 12 inches. Additionally, the use of an underlying filter layer of gravel or geotextile filter fabric was recommended to prevent soil movement into or through the rip rap (E & E, 2014b). However, the installation of filter fabric would require extensive clearing and grubbing on steep slopes, and would be relatively difficult to install on slopes steeper than about 3:1 H:V. Additionally, improperly designed or executed methods of geotextile fabric installation may exacerbate the erosion of underlying fine contaminant material, lead to a loss of rock cover, and/or require the construction of hardened channels. Therefore, for the purpose of the conceptual design for this alternative, it was assumed that the installation of filter fabric would be considered during the design phase should this alternative be selected, and geotextile fabric was not included in the material or labor estimates described in this EE/CA. If it is added during the design phase, the addition of a geotextile layer would not change the estimated cost of the alternative outside of the allowable +30%/-50% range.
- The OU-3 Alternatives involve disturbance on up to 20.0 acres of land. EPA recognizes the potential for invasive plant species to re-occupy the disturbed land. Any work implemented on OU-3 land parcels would consider the potential for re-occupation of disturbed land by invasive plant species, and measures would be taken to minimize this

concern. Specific approaches to minimize invasive plant species on disturbed land would be developed during the design phase of the project.

- The OU-3 Alternatives involve covering sizeable areas with soil or rock. Any work implemented on OU-3 land parcels would consider the aesthetic features of the finished product. To the extent practical, during the design phase of the project, EPA would develop approaches that would make the disturbed land areas more aesthetically attractive. Examples of such approaches could include, but are not limited to: varying coloration of rocked areas; incorporating larger rocks or other features into rocked areas; and incorporating vegetated areas into rocked areas.

ICs would be recommended at OU-3 land parcels. These ICs would typically restrict the property owners from performing any intrusive soil excavation work without performing additional measures. The IC program would be implemented in the same manner as described for OU-1. The following sections (8.3.2 through 8.3.4) describe the various removal alternatives evaluated for OU-3.

8.3.2 OU-3 Removal Alternative 1 – No Action

Under the No Action alternative, no additional sampling or removal actions would occur, and no additional direct costs would be incurred. These areas may continue to act as ongoing sources of contamination via exposure routes that include fugitive dust, contaminated surface runoff, and direct contact pathways.

8.3.3 OU-3 Removal Alternative 2 – Smelter and Mill Footprint Area 1-Foot Soil Excavation and Removal with a 1-Foot Soil and/or Rock Cover on >10% Slopes; and ICs

Currently there is an estimated total of 897,817 sq. ft. (20.62 acres) of contaminated soil within OU-3. Under this alternative, contaminated soil at undeveloped land parcels identified within OU-3 would generally be excavated to 1 foot bgs, and covered either with 1 foot of clean fill in relatively level areas or covered with a minimum of 1 foot of clean imported 4-inch to 8-inch rock in areas where slopes exceed approximately 10%.

Implementing this alternative would require excavation and disposal of approximately 33,252 CY of contaminated soil, and import of approximately 5,736 CY (approximately 3.5 acres) of clean compacted backfill in residential areas, and approximately 27,600 CY (17.1 acres) of clean 4-inch to 8-inch crushed rock for a 1-foot-thick layer in sloped areas. For costing purposes, it was assumed that excavated soils do not meet the legal definition of a hazardous waste and therefore do not require stabilization prior to disposal in a landfill.

8.3.4 OU-3 Removal Alternative 3 – Smelter and Mill Footprint Area Slope Capping with 1 Foot of Rock (Rock Slope Protection); Limited 1-Foot Soil Excavation and Removal with a 1-Foot Soil Cap in Residential Areas; and ICs

Currently there is an estimated total of 897,817 sq. ft. (20.62 acres) of contaminated soil within OU-3. Under Removal Alternative 3, contaminated soil at undeveloped land parcels identified within OU-3 would generally be covered with a minimum of 1 foot of clean imported 4-inch to

8-inch rock. Rock cover would be generally placed under the specifications described above under OU-3 Alternative 2 (E & E 2014b). However, given the intent of potential residential development at undeveloped land parcels within Hillside No. 2, contaminated soil (5,736 CY) would generally be excavated to 1 foot bgs, and covered either with 1 foot of clean fill in relatively level areas, or covered with a minimum of 1 foot of clean imported 4-inch to 8-inch rock in areas where slopes exceed approximately 10% (E & E 2014b).

Using this OU-3 alternative would require the excavation and disposal of approximately 5,736 CY of contaminated soil in residential areas, approximately 5,736 CY of clean compacted backfill, and approximately 27,600 CY of clean 4-inch to 8-inch crushed rock for the remaining OU-3 areas.

8.4 OU-4 EUREKA CREEK

Sediments in Eureka Creek, which flows through the Town of Eureka, contain lead and arsenic at concentrations above the site-specific action levels for residential soil. The exact vertical and horizontal extent of contaminants has not been adequately determined, and additional characterization would likely be required. However, for purposes of this EE/CA it was assumed that 6,200 linear feet of the Eureka Creek channel located within the Town of Eureka would need to be addressed to prevent potential human-health risks from direct contact with sediment or surface water, and potential risks to the riparian ecosystem. The areas assumed to require excavation are shown on Figure 16. For costing purposes, an average channel bed width of 35 linear feet was assumed based on calculated measurements using satellite imagery.

Alternatives that include removal actions in Eureka Creek were assumed to require traffic control to promote safe access for equipment and materials into and out of the work zones. Soil disposal costs were estimated based on the unit rates for the various disposal options discussed under OU-5. For costing purposes, it was assumed that excavated soils/sediments do not meet the legal definition of a hazardous waste and therefore do not require stabilization prior to disposal in a landfill.

8.4.1 OU-4 Removal Alternative 1 – No Action

Under the No Action alternative, no direct actions would be performed to remediate contaminated sediments in Eureka Creek. Concentrations would be allowed to attenuate naturally via the flushing action of periodic flood events. If enough of the suspected sources of contaminated sediment are addressed (e.g., contaminated areas within the Town of Eureka, including the slag piles), concentrations are expected to decrease. However, the decrease may be slow, on the order of decades or centuries as contamination migrates downstream and is presumably mixed with clean sediments entering the system.

8.4.2 OU-4 Removal Alternative 2 – Limited Excavation and Removal of 1.5 Feet of Soil/Sediments; and Rip Rap Armoring

Under this alternative, contaminated portions of Eureka Creek not already covered with rip rap would be excavated to a depth of 1.5 feet below the existing channel bottom. Approximately 12,028 CY of contaminated sediment is estimated for removal. Rock rip rap would be placed back in the channel in an 18-inch-thick layer. Sediment and erosion control measures would be installed as necessary. These may include the construction of sediment basins, diversion channels, and other significant features required to prevent damage to work in progress or the environment.

8.4.3 OU-4 Removal Alternative 3 – Excavation and Removal of 2.5 Feet of Soil/Sediments; In-Place Capping with 1 Foot of Clean Fill; and Rip Rap Armoring

Under this alternative, impacted portions of Eureka Creek not already covered with rip rap would be excavated to a depth of 2.5 feet below the existing channel bottom. One foot of clean imported fill would be placed and compacted into the channel bed. After the fill is placed, 18 inches of rock rip rap would be installed in the channel. Sediment and erosion control measures would be installed as necessary. These may include the construction of sediment basins, diversion channels, and other significant features required to prevent damage to work in progress or the environment.

8.5 OU-5 CONTAMINATED MATERIAL DISPOSAL

The purpose of this section is to describe the various alternatives proposed for disposing contaminated materials generated during each of the previously discussed OU removal alternatives. Depending on which of the above removal alternatives are selected, and including the 10,600 CY of contaminated soil currently stockpiled at the Site, the estimated volume of non-hazardous waste material that would require disposal ranges from 10,600 CY to 136,000 CY and the estimated volume of hazardous waste material (slag) that would require disposal ranges from 130 CY to 60,900 CY.

Table 21: Waste Disposal Volumes by OU and Alternative

OU Number	Alternatives and Associated Waste Disposal Volumes (CY)					Minimum Volume for Disposal (CY)	Maximum Volume for Disposal (CY)	Maximum Volume for Disposal (Tons)
	Alt-1	Alt-2	Alt-3	Alt-4	Alt-5			
OU-1	10,600	54,800	62,210	--	--	10,600	62,210	84,980
OU-2	NA	81,700	81,700	NA	NA	0	81,700	28,080 soil 91,350 slag
OU-3	NA	33,250	5,736	--	--	0	33,250	44,890
OU-4	NA	12,028	21,050	--	--	0	21,050	28,420
				TOTALS[3]		**10,600**	**198,200**	**186,370 soil** **91,350 slag**

Notes:
-- = Not an Alternative
CY = cubic yards
NA = No Action or Not Applicable (no waste generated)
1. Volumes include existing 10,600 CY stockpile.
2. Slag Pile volumes include 2 feet of soil beneath footprint of slag pile.
3. All volumes are in-place cubic yards (expansion factor not added/shown).
4. Conversion factor of 1.35 tons per yard used for soil, and 1.5 tons per cubic yard used for slag.
5. Approximately 60,900 CY of slag is assumed to be RCRA hazardous waste subject to land disposal restrictions and requiring crushing and stabilization prior to disposal.

8.5.1 OU-5 Disposal Alternative 1 – Offsite Disposal of Removal Waste at an Existing Landfill

Under this alternative, the existing 10,600 CY of stockpiled soil at the Site, and up to the additional estimated 126,900 CY of assumed non-hazardous contaminated material generated from the Site would be loaded and transported to an existing landfill facility permitted to receive contaminated material (RCRA Subtitle D). The estimated 60,900 CY of assumed hazardous contaminated material (slag) generated from the Site would be crushed, stabilized to prevent leachable metals from discharging from the waste, then loaded and transported to an existing landfill facility permitted to receive hazardous waste (RCRA Subtitle C).

Assuming an average density of 1.35 tons of soil per CY for residential soils, an average density of 1.5 tons per CY for slag, and an average load capacity of 24 tons per truck, an estimated 597 to 11,540 truckloads of soil would be generated. Due to the relatively small size of the local roads and highways in the Town of Eureka, it is assumed that the maximum average amount of soil that could be loaded each day would be limited to 100 truckloads. Since some soil would presumably be loaded directly into trucks, especially if the slag piles are excavated, it was assumed that approximately half of the total estimated potential removal volume of 198,000 CY would be loaded from stockpiles, requiring extra material handling and the nearly continuous loading of trucks. On days where large truck volumes are anticipated, it is assumed that active traffic control (signs, barricades, flaggers, etc.) would be required. Depending on what alternatives are implemented, it is estimated that the removal of all wastes could take between 4 and 5 years, assuming an annual 6-month construction season.

8.5.2 OU-5 Disposal Alternative 2 – Disposal of Soil at a Locally Constructed Landfill, and Offsite Disposal of Slag Piles at an Existing Landfill Facility

Under this alternative, a total of 137,500 CY of contaminated soil from OU-1 through OU-4 would be disposed of at a locally constructed landfill located within the Town of Eureka and 60,900 CY of slag would be crushed, stabilized, and disposed of at an existing off-site landfill. An approximate area of 10 acres would need to be set aside for use as a local landfill. It was assumed that Eureka County would provide the land for this landfill and that the County would operate and maintain the landfill after it was constructed by EPA.

The actual design of the landfill would occur during a design phase intended to evaluate the most cost-effective and protective type and location for the landfill. However, for costing purposes it was assumed that a 4-foot-thick evapotranspiration (ET) cover, no steeper than 4:1 H:V, would be constructed over the waste. Based on the assumed ET cover, the approximate volume of cap material required is 56,600 CY. For costing purposes it was assumed that fill would be purchased, imported, and placed at an approximate cost of $23 per square yard. However, the feasibility of excavating cap material from this area should be evaluated during the design phase. If on-site soils can be used for cap material, an estimated savings of $400,000 could be achieved.

For costing purposes, it was assumed that a 2,350-foot-long rock-lined channel would be constructed around the downslope edges of the repository to stabilize the toe and prevent erosion. The repository would be stabilized and restored using conventional hydroseeding methods.

For costing purposes, it was assumed that slag would be disposed of at an off-site landfill. However, soil beneath the slag would be disposed of in the local landfill. Based on a total soil disposal volume of approximately 144,400 CY, (which includes the 5% allowance for expansion of soils and/or excess capacity), a conceptual design was created and a cost estimate was generated. Costs for the construction were summed and divided by the 198,000 CY excavation total (i.e., no expansion factor). The average disposal cost per CY for this option is $137.00.

8.5.3 OU-5 Alternative 3A – Disposal of Maximum Estimated Soil from OU-1, OU-3, and OU-4 at a Locally Constructed Landfill

Under this alternative, soils excavated from OU-1, OU-3, and OU-4 would be hauled to a repository that would be constructed within the Town of Eureka. It was assumed that Eureka County would provide the land for this landfill and that the County would operate and maintain the landfill after it was constructed by EPA.

This alternative assumes that slag and soil beneath the slag would not be placed in this repository. For costing purposes it was assumed that a 2,000-foot-long, rock-lined channel would be constructed around the downslope edges of the repository to stabilize the toe and prevent erosion. The repository would be stabilized and restored using conventional hydroseeding methods.

Preliminary calculations indicate that 142,000 CY to 195,000 CY could be stored in the proposed repository. The maximum volume of soil that might be excavated from OU-1, OU-3, and OU-4 was estimated at 114,500 CY. Based on an assumed 4-foot-thick ET cover, the volume of cap material required would be 56,000 CY. For costing purposes it was assumed that fill would be imported at an approximate cost of $23 per square yard. However, the feasibility of excavating cap material from this area should be evaluated during the design phase. If on-site soils can be used for cap material, an estimated savings of $370,000 could be achieved.

8.5.4 OU-5 Disposal Alternative 3B – Disposal of Residential Soil at a Locally Constructed Landfill

Under this alternative, only soils excavated from OU-1 would be hauled to a repository constructed in the Town of Eureka. As with OU-5 Alternatives 2 and 3A, it was assumed that Eureka County would provide the land for this landfill and that the County would operate and maintain the landfill after it was constructed by EPA. It was also assumed that a 4-foot-thick ET cap would be constructed over the waste. A 1,500-foot-long, rock-lined channel would be constructed around the downslope edges of the repository to stabilize the toe and prevent erosion. The repository would be stabilized and restored using conventional hydroseeding methods.

Preliminary calculations indicate that the estimated 60,200 CY (63,200 with 5% expansion factor) of residential soil could easily be stored in this repository. Based on an assumed 4-foot thick ET cover, the volume of cap material required would be 32,200 CY. For costing purposes it was assumed that fill would be imported at an approximate cost of $23 per square yard. However, the feasibility of excavating cap material from this area should be evaluated during the design phase. If on-site soils can be used for cap material, an estimated savings of $250,000 could be achieved.

Additionally, in the event that the OU-3, Alternative 3 (Limited Excavation of Smelter Footprint Areas) option is selected, the repository could be easily modified to accommodate the additional estimated 5,700 CY of soil that would need to be disposed from the OU-3 area. Based on the unit costs in Table B-16 in Appendix B, this would increase the cost for this disposal option by $411,000. However, because of the uncertainty as to whether OU-3 Alternative 3 will be executed, this additional cost is not included in the estimate for the OU-5 Alternative 3B disposal option. In any case, the additional cost is not expected to change the total cost for this option outside the allowable +50%/-30% range.

9. COMPARATIVE ANALYSIS OF REMOVAL AND DISPOSAL ACTION ALTERNATIVES

The detailed analysis of removal and disposal alternatives is intended to provide the relevant information required to select a preferred action for each OU at the Site. Identified alternatives were evaluated on the basis of effectiveness, implementability, and cost, as set forth in the NCP and EPA guidance on conducting an EE/CA for a removal action (EPA, 1993). A summary of the analyses of the individual alternatives is included as Appendix D.

9.1 ALTERNATIVE ANALYSIS APPROACH

This section describes the three criteria (effectiveness, implementability, and cost) evaluated for the identified removal and disposal alternatives.

9.1.1 Effectiveness

Effectiveness refers to the ability of an alternative to meet the RAOs. The following criteria are used to evaluate effectiveness:

Overall Protection of Human Health and the Environment – This criterion provides a final check to assess whether each alternative provides adequate protection of human health and the environment. The assessment of overall protection draws on the evaluation of the other criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Evaluation of the overall protectiveness of an alternative focuses on whether a specific alternative achieves adequate protection and would describe how site risks posed through each pathway are being addressed by the EE/CA and are eliminated, reduced, or controlled through treatment, engineering, or ICs. This evaluation allows for consideration of whether an alternative poses any unacceptable short-term or cross-media impacts.

Compliance with ARARs – This criterion is used to determine whether each alternative would meet the identified ARARs. The detailed analyses summarize which requirements are applicable, relevant, and appropriate to an alternative and describe how the alternative meets these requirements.

Long-Term Effectiveness and Permanence – This criterion evaluates results of the removal action in terms of the risk remaining at the Site after RAOs have been met. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes remaining at the Site.

Short-Term Effectiveness – This criterion evaluates the effects that the alternative would have on human health and the environment during its construction and implementation phase. It includes both exposure risks to the contaminated soils and risks to the workers and communities from construction work and traffic during implementation and the time necessary to complete the action.

9.1.2 Implementability

This criterion evaluates the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required to construct and provide operations and maintenance (O&M). The following criteria are used to evaluate implementability:

- Technical feasibility
- Administrative feasibility
- Availability of services and materials

Also considered is the reliability of the technology, the ability to monitor the effectiveness of the remedy, and the ease of undertaking additional remedial actions, if necessary.

9.1.3 Cost

Cost estimates were prepared for actionable removal alternatives and their associated sub-options, to allow for the comparison of the efficacy of the alternatives and to support remedy selection. The types of costs that were assessed were in accordance with the requirements for similar remedial actions found in 40 CFR 300.430 (e)(9)(iii)(G) and include the following:

- Capital costs, including both direct and indirect costs
- Annual O&M costs
- Net present value (NPV) of capital and O&M costs

In accordance with EPA guidance, the cost estimates were prepared to provide accuracy in the range of +50/-30%. A NPV analysis relates costs that occur over different time periods to present costs by discounting all future costs to the present value. This allows the cost of removal alternatives to be compared on the basis of a single figure that represents the capital required in 2015 dollars to construct, operate, and maintain the removal alternative throughout its planned life. The NPV calculations were based on a discount rate of 7%, which represents the average rate of return on private investment, before taxes and after inflation. Cost estimates are located in Appendix B.

The scope and costs presented for the various alternatives are based on the best available information regarding current site conditions and readily available information on the applicability and effectiveness of the selected removal alternative. In preparing the cost estimates, conservative assumptions have been used and an overall contingency has been added to each alternative to account for these uncertainties.

Changes in the cost elements are likely as new information and site conditions change during the removal action design. Cost assumptions are included in Appendix B.

Actual costs may vary from these estimates depending on variations in actual site conditions from those estimated, such as weather conditions, inflation, actual fuel costs, actual insurance and bonding costs, the availability of materials, equipment, labor, changes in regulatory requirements, and other factors that are difficult to estimate or control.

CERCLA and the NCP require that every remedy selected must be cost-effective. A Remedial Disposal Alternative is cost-effective if its “costs are proportional to its overall effectiveness” *(40 CFR 300.430(f) (1) (ii) (D)).* Overall effectiveness of a removal, remedial, or disposal alternative is determined by evaluating protectiveness, long-term effectiveness, and short-term effectiveness. Overall effectiveness is then compared to the cost to determine whether the remedy is cost-effective.

9.2 UNAVOIDABLE IMPACTS COMMON TO ALL REMOVAL AND DISPOSAL ALTERNATIVES

Except for Alternative 1 (No Action) under OU-1, OU-2, OU-3, and OU-4, each of the removal and disposal action alternatives would result in an overall improvement to the local environment. However, for the removal and disposal action alternatives, it is important to note that there would be some unavoidable impacts. These include:

- General disturbance to the local residents from heavy equipment activity for the assumed construction periods, and increased truck traffic on local roads, which may include temporary local road detours.
- Disruption of wildlife access to the completed removal and disposal action areas due to the construction activities, and potentially for 1 to 5 years afterwards for vegetation establishment.
- Long-term O&M activities are required for caps/covers, storm water diversion measures, and walls or fencing.

9.3 ALTERNATIVE 1 ANALYSIS – NO ACTION FOR OU-1, OU-2, OU-3 AND OU-4

The No Action alternative does not provide protection to human or environmental exposure, nor is it considered a permanent remedy because it does not reduce the toxicity, volume, or mobility of hazardous waste at the Site. The No Action alternative has been included as a requirement of the NCP and to provide a basis for the comparison of the remaining alternatives. It should be noted that No Action at OU-2 (Slag Piles) sites is unlikely to eliminate the requirement for property owners of these sites to procure and maintain a National Pollutant Discharge Elimination System (NPDES) permit in accordance with Clean Water Act requirements. This would typically include preparation of a Storm Water Pollutant Prevention Plan (SWPPP) and implementation of best management practices designed to minimize or prevent the discharge of contaminants from industrial sites such as mines and smelters.

9.3.1 Effectiveness

This alternative would not minimize the potential exposure to, or transport of, contaminated soils from the Site. This alternative would provide no control of soil concentrations or mobility, or reduce risks to human health or the environment. The resultant risks associated with the No Action alternative would be similar to those that existed at the time of the field investigations.

Therefore, increased protection of human health and the environment would not be achieved under the alternative.

Residents would continue to be potentially exposed to soil contamination through direct contact, dust inhalation, and wind-borne contaminants. Surface water discharge from the Site to Eureka Creek would have the continued potential to transport contaminants to the downstream watershed. Domestic livestock, and fruits and vegetables would potentially be exposed to soil and surface water contamination through direct contact and uptake.

Other than local routine storm water pollution prevention maintenance and local vegetation maintenance, no controls or long-term measures would be implemented to control contaminated soils at the Site under the No Action alternative; therefore, this alternative offers no long-term or short-term effectiveness in reducing potential risks to human and ecological receptors.

The effectiveness of the No Action alternative is considered low for achieving the RAOs.

9.3.2 Implementability

This alternative is easily implemented because there is no construction or permitting considerations. EPA guidance requires that the reliability of the technology be considered along with feasibility. Since No Action is inherently an unreliable remedy, this criterion is rated low.

9.3.3 Cost

The NPV of Alternative 1 for OUs 1, 2, 3, and 4 is estimated to be $0. There are no new direct or indirect capital costs, annual O&M, or monitoring costs associated with this alternative. Any costs for compliance with NPDES requirements for exposed industrial waste would presumably be borne by the individual property owners. To determine whether the remedy is cost-effective the overall effectiveness is compared to the cost. Because the overall effectiveness of Alternative 1 is low and does not currently meet the ARARs for the protection of human health or the environment, the cost-effectiveness of Alternative 1 is low.

9.4 OU-1 REMOVAL ALTERNATIVE 2 ANALYSIS – SOIL REMOVAL AND CAPPING AT TIER I AND TIER II PROPERTIES; ICs; AND OUTREACH AND EDUCATION PROGRAMS

Implementation of OU-1 Removal Alternative 2, soil removal and capping at Tier I and Tier II properties; ICs at Tier III properties; and implementing an outreach and education program at the Site would require the following steps:

- Excavate identified contaminated soil from Tier I and Tier II properties.
- Capping, grading, and site restoration at excavation areas on Tier I and Tier II properties with appropriate fill materials.
- Implement ICs for the Site.
- Implement an outreach and education program for the Site.

9.4.1 Effectiveness

The effectiveness of OU-1 Removal Alternative 2 is considered medium for achieving the RAOs. This alternative would significantly minimize potential exposure to contaminated soils at Tier I and Tier II residential properties at the Site. However, lead and arsenic concentrations in some areas at Tier 3 properties may remain above the EPA's RSLs for soil in a residential scenario. This alternative would provide some control of soil concentrations, limit mobility at Tier I and Tier II properties, and therefore reduce risks to human health and the environment at the Site. Potential exposures at Tier III properties would be reduced through ICs. In addition, long-term ICs and education and outreach programs would increase awareness of contaminants and minimize potential exposure to contaminated soils at the Site. However, the potential for wastes at Tier III properties to migrate from those properties would still exist and elevated lead and arsenic concentrations would remain at Tier III properties. Therefore, a medium long-term level of protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Chemical-specific TBCs (Table 15) would be met (Site-Specific Cleanup Levels). Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037
- Water (Federal) - Section 404 of the CWA – 33 U.S.C. § 1344, 40 CFR 230 and 231

Potential limited exposures during excavation, transport, and off-loading at the final disposal site would be managed through engineering controls and personal protective equipment (PPE). The short-term effectiveness of this alternative is considered medium because of the disturbance of the contaminated soil waste and the large amount of truck and heavy equipment traffic that workers and the community would be subject to. The primary considerations for short-term effectiveness are protection of the community, workers, and environmental impacts both during and after implementation. This alternative involves excavation, material transfer, stockpile development/management, loading of bulk carriers, and site restoration activities. Heavy equipment would be used to clear and grub, excavate, transfer, load, and grade impacted materials. Potential exposure and protection procedures for workers engaged in these activities would be addressed in detail under the Site health and safety plan. During excavation and material handling activities, measures would be taken to reduce fugitive dust emissions and associated impacts to workers and residents. Water would be imported for dust control, and workers in the controlled area would don the appropriate safety equipment and implement safety practices such as air monitoring. Work areas would be secured (e.g., marked or fenced) to ensure access by authorized personnel only.

The short-term and long-term effectiveness are considered medium, because the effectiveness of the alternative with respect to Tier III properties is dependent on the effectiveness of the IC program, as there is no remediation of Tier III properties. To the extent that the ICs implemented by Eureka County and NDEP are not able to ensure the long-term integrity of the cleanup actions, or where property owners, particularly those living on or in close proximity to source areas, do not comply with the ICs, EPA would reserve the right to negotiate directly with those property owners regarding the implementation of ICs, or to take appropriate enforcement actions as necessary.

9.4.2 Implementability

OU-1 Removal Alternative 2 rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated capping or barrier hardening activities. Residential sites are also generally readily accessible. Excavation would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors.

The excavation of contaminated material would be accomplished using a variety of conventional equipment. Heavy equipment needed for this project such as scrapers, excavators, dozers, loaders, compactors and/or bulk carriers are commercially available. Working space is available for establishing temporary construction office trailers. Electricity is typically available at each residence and portable sanitary services and refuse disposal services are locally available. Construction materials (e.g., backfill and sod) for capping/covering and site restoration activities are commercially available. Off-site water would be required for construction water and is readily accessible. On-site and off-site laboratories for sample analyses are readily available.

Trained and experienced labor is available for site work activities. Special certifications and training requirements are commercially available. Health and safety training to comply with Occupational Safety and Health Administration (OSHA) regulations, including hazardous material handling training is available. However, it is likely that specialized crews trained in hazardous waste operations (HAZWOPER) would need to be at the Site, at least for the first construction season. Cultural resource liaisons are commercially available. Site-specific ICs and outreach and education programs are readily achievable based on former EPA experience at comparable sites throughout the western U.S.

9.4.3 Cost

The NPV of OU-1 Removal Alternative 2, excluding disposal, is estimated to be $16,650,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness, short-term effectiveness, and permanence are all considered medium. Because the cost is comparable to previous residential removal actions, the overall cost-effectiveness of Alternative 2 is medium.

9.5 OU-1 REMOVAL ALTERNATIVE 3 ANALYSIS – SOIL REMOVAL AND CAPPING AT TIER I, TIER II, AND TIER III PROPERTIES; ICs; AND OUTREACH AND EDUCATION PROGRAMS

Implementation of OU-1 Removal Alternative 3, soil removal and capping at Tier I, Tier II, and Tier III properties; ICs; and, outreach and education programs would require the following steps:

- Excavate identified contaminated soil from Tier I, Tier II, and Tier III properties.
- Capping, grading, and site restoration at excavation areas on Tier I, Tier II, and Tier III properties with appropriate fill materials.
- Implement ICs for the Site.
- Implement an outreach and education program for the Site.

9.5.1 Effectiveness

The effectiveness of OU-1 Removal Alternative 3 is considered high for achieving the RAOs. This alternative would significantly minimize potential exposure to contaminated soils at all three tiers of residential properties at the Site. This alternative would provide control of soil concentrations, mobility, and a reduction in risk to human health and the environment at the Site. Potential limited short-term exposures during excavation, transport, and at the final disposal site would be managed through engineering controls and PPE. However, similar to OU-1 Alternative 2, the workers, residents, and community members would be subject to increased dust levels, traffic, and emissions from passenger vehicles, heavy equipment, and trucks. Therefore, a medium level of short-term protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Based on the measured bioavailability and assumed exposure periods discussed in Section 5.3, Federal and State ARARs for acceptable risk levels would be met for all three residential tiers under this alternative. Chemical-specific TBCs (Table 15) would be met (Site-Specific Cleanup Levels). Action-specific ARARs (Table 17) for this alternative include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037

Short-term effectiveness of this alternative is medium because of the disturbance of the contaminated soil waste. The primary considerations for short-term effectiveness are protection of the community, workers, and environmental impacts both during and after implementation. This alternative involves excavation, material transfer, stockpile development/management, loading of bulk carriers, and site restoration activities. Heavy equipment would be used to clear and grub, excavate, transfer, load, and grade and cap impacted materials. Potential exposure and protection procedures for workers engaged in these activities would be addressed in detail under a Site safety and health plan. During excavation and material handling activities, measures would be taken to reduce fugitive dust emissions and associated impacts to workers. Water would be imported for dust control, and workers in the controlled area would don the appropriate safety equipment and implement safety practices such as air monitoring. Work areas would be secured (i.e., marked or fenced) to ensure access by authorized personnel only.

Long-term effectiveness of this alternative is high. Since contaminated soils would be excavated and removed, potential exposure reductions to those accessing the Site would be permanent. In addition, long-term ICs, and education and outreach programs would increase awareness of contaminants and minimize potential exposure to contaminated soils at the Site. To the extent that the ICs implemented by Eureka County and NDEP are not able to ensure the long-term integrity of the cleanup actions, or where property owners, particularly those living on or in close proximity to source areas, do not comply with the ICs, EPA would reserve the right to negotiate directly with those property owners regarding the implementation of ICs, or to take appropriate enforcement actions as necessary.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.5.2 Implementability

OU-1 Removal Alternative 3 rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities. Residential sites are also readily accessible. Excavation would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors. Profiling and manifesting of the material would be done in coordination with the transporters and off-site disposal facility.

The excavation of contaminated material would be accomplished using a variety of conventional equipment. Heavy equipment needed for this project such as scrapers, excavators, dozers, loaders, compactors and/or bulk carriers are commercially available. Working space is available for establishing temporary construction office trailers. Electricity is already available at the Site and portable sanitary services and refuse disposal are locally available. Construction materials (e.g., backfill and sod) for capping/covering and site restoration activities are commercially available. Off-site water would be required for construction water and is readily accessible. On-site and off-site laboratories for sample analyses are readily available.

Trained and experienced labor is available for site work activities. Special certifications and training requirements are commercially available. Health and safety training to comply with

OSHA regulations, including hazardous material handling training is available. Cultural resource liaisons are commercially available. Site-specific ICs and outreach and education programs are readily available based on former EPA experience at comparable sites throughout the western U.S.

9.5.3 Cost

The NPV of OU-1 Removal Alternative 3, excluding disposal, is estimated to be $17,910,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence is high while the short-term effectiveness is medium. Because the long-term effectiveness and permanence are the highest of any of the three residential alternatives, and the costs are similar to Alternative 2, the cost-effectiveness of Alternative 3 is considered high.

9.6 OU-2 REMOVAL ALTERNATIVE 2 ANALYSIS – REMOVAL OF SLAG PILES TO AN EXISTING LANDFILL; AND ICs

Implementation of OU-2 Removal Alternative 2, removal of slag piles to an existing landfill, and ICs would require the following steps:

- Excavate slag piles and an assumed 2-foot-thick layer of underlying contaminated soil.
- Crushing slag materials to a particle size of 1-inch or less and stabilization.
- Transportation of slag materials to an existing off-site hazardous waste landfill, and transportation of a 2-foot soil layer to an existing off-site landfill.
- Capping, grading, site restoration and bank stabilization at excavation areas.
- Implement ICs for the Site.

9.6.1 Effectiveness

The effectiveness of OU-2 Removal Alternative 2 is considered high for achieving the RAOs. This alternative would eliminate potential exposure to highly contaminated slag materials at the Site via the direct contact, fugitive dust, and surface water runoff exposure pathways. It would also greatly reduce or eliminate the possibility of soluble contaminants migrating away from the Site and affecting downstream human or environmental receptors. This alternative provides control of slag and soil concentrations via removal and reduces the mobility of any remaining contaminants via capping. Potential limited exposures during excavation, transport, and at the final disposal site would be managed through engineering controls and PPE. Because all or almost all of the waste would be placed in a lined landfill located outside of Eureka County, this alternative provides the highest level of protection for human health and the environment. The applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative, including the chemical-specific TBCs (Site-Specific Cleanup Levels) for slag piles located near or on residential property. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037
- Surface Water (Federal) – CWA 33 U.S.C. §1342; NPDES 40 CFR Parts 122 and 125; U.S.C. §1344, 40 CFR 230 and 231

Short-term effectiveness of this alternative is considered the lowest of any of the OU-2 slag pile alternatives because of the relatively large disturbance of the contaminated slag waste. The primary considerations for short-term effectiveness are protection of the community, workers, and environmental impacts both during and after implementation. This alternative involves the most excavation, material transfer, stockpile development/management, loading of bulk hazardous material carriers, truck traffic, fossil fuel use, and site restoration activities. Heavy equipment would be used to clear and grub (as needed), excavate, transfer, load, and grade impacted materials. Potential exposure and protection procedures for workers engaged in these activities would be addressed in detail under the Site safety and health plan. During excavation and material handling activities, measures would be taken to reduce fugitive dust emissions and associated impacts to workers. Water would be imported for dust control, and workers in the controlled area would don the appropriate safety equipment and implement safety practices such as air monitoring. Work areas would be secured (i.e., marked or fenced) to ensure access by authorized personnel only.

Bulk carriers hauling the containerized wastes off-site would be covered and secured and weighed to document compliance with total and axle load limits. Truck traffic would be coordinated under a transportation plan for routes, times of operation, and on-site traffic rules. Emergency spill containment and cleanup contingency actions would also be included in the transportation plan to address material spills. Due to the large number of truckloads (approximately 4,977 truckloads of soil and slag), and the long drive to the disposal facility, it is estimated that the time period of implementation of Alternative 2 could be completed in one or two construction seasons (April through November). Table B-5 assumes one season for the purpose of cost estimating. Because it is considered administratively and technically simple, one year of planning, design, and permitting was estimated.

Since none of the existing permitted landfills are located within 4 hours drive time of the Site, this alternative also has the highest amount of trucking and heavy equipment use in total vehicle hours. For example, at an assumed weight of 24 tons per truckload and an operated vehicle time of 10 hours per load, the estimated 4,977 truckloads of contaminated slag and soil would necessitate an expenditure of approximately 52,251 hours of vehicle run time for disposal. In comparison, the estimated vehicle run time for OU-2 Alternative 3 (i.e., grading and importing and placing cap material) is estimated to be in the low thousands of hours (approximately 10% of the Alternative 2 total). This estimate assumes that, similar to the previously performed residential removal actions, a source of material is located within a 50-minute round trip from the Town of Eureka.

Based on these estimates, Alternative 2 has the highest potential for additional vehicular accidents, increased wear and tear on infrastructure (streets, bridges, and highways), produces the highest amount of air pollution (from particulate matter and oxides in vehicle exhaust), traffic closures and associated inconvenience to the general public, and uses the greatest amount of fossil fuels. Because of the large number of hours of equipment operation, and the associated potentially noisy crushing and stabilization operations required, which also potentially expose workers to more respirable forms of lead and arsenic than any other alternative, Alternative 2 is ranked the lowest of the three OU-2 alternatives in short-term effectiveness.

Long-term effectiveness of this alternative is high. Since contaminated slag and soils would be excavated and removed, potential exposure reductions to those accessing the Site would be permanent. In addition, long-term ICs would increase awareness of any residual contaminants and minimize potential exposure to potentially contaminated soils at the Site.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.6.2 Implementability

OU-2 Removal Alternative 2 rates low in technical and administrative implementability. Although it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities and the slag pile sites are accessible, it would likely require procurement of a permit from the U.S. Army Corps of Engineers (USACE) in compliance with Section 404 of the Clean Water Act (Section 404 Permit). Additionally, the slag waste would be considered hazardous waste subject to land disposal restrictions if it were hauled off-site. Therefore, it would require the additional measures of crushing and stabilizing it, and hauling it as hazardous waste. Procurement of and compliance with a permit from the USACE in accordance with Section 404 of the Clean Water Act typically requires specialized hydraulic and hydrologic modeling and can take 2-4 years to obtain. The USACE typically also requires ongoing monitoring once the action is completed.

Excavation would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to the general public and sensitive receptors. Profiling and manifesting of the material would be done in coordination with the transporters and off-site disposal facility.

The excavation of contaminated material would be accomplished using a variety of conventional equipment. Heavy equipment needed for this project such as scrapers, excavators, dozers, loaders, compactors and/or bulk carriers are commercially available. Crushing and stabilization equipment are specialty items but could be imported to the Site. Working space is available for establishing temporary construction office trailers. Electricity is already available at the Site and portable sanitary services and refuse disposal are locally available. Construction materials (e.g., backfill, rip rap) for capping/covering and site restoration activities are commercially available.

Off-site water would be required for construction water and is readily accessible. On-site and off-site laboratories for sample analyses are readily available.

Trained and experienced labor is available for site work activities. Special certifications and training requirements are commercially available. Health and safety training to comply with OSHA regulations, including hazardous material handling training is available. Cultural resource liaisons are commercially available. Site-specific ICs are readily available based on former EPA experience at comparable sites throughout the western U.S.

9.6.3 Cost

The capital costs for OU-2 Removal Alternative 2 are $3,233,000; however, the NPV cost including disposal is estimated to be $22,431,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence is high while the short-term effectiveness is low. Because the cost is over 400% more than Alternative 3 and provides a similar level of protection, the cost-effectiveness of Alternative 2 is very low.

9.7 OU-2 REMOVAL ALTERNATIVE 3 ANALYSIS – CONSOLIDATION, GRADING, AND IN-PLACE CAPPING OF SLAG PILES WITH A 2-FOOT SOIL COVER; AND ICs

Implementation of OU-2 Removal Alternative 3, consolidation, grading, and in-place capping of slag piles with 2 feet of soil cover; and, ICs would require the following steps:

- Consolidation and grading of approximately 10,000 CY of slag piles to fill existing holes, voids, and low-lying areas.
- Capping slag piles using either 2-feet of compacted clean fill, or a HDPE geomembrane liner and then 2-feet of compacted clean fill.
- Import clean fill as necessary to establish grades and surface water drainage patterns.
- Excavate portions of adjacent surface water drainage(s) and stabilize with rip rap and potentially an HDPE liner to reduce erosion.
- Implement ICs for the Site.

9.7.1 Effectiveness

The effectiveness of OU-2 Removal Alternative 3 is considered high for achieving the RAOs. This alternative would significantly minimize potential exposure to highly contaminated slag materials at the Site. This alternative would provide control of slag concentrations, greatly reduce or eliminate their mobility, and a reduce risks to human health and the environment at the Site to levels within the acceptable risk range. Potential limited exposures during consolidation and grading of the slag would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037
- Surface Water (Federal) – CWA 33 U.S.C. §1342; NPDES 40 CFR Parts 122 and 125; U.S.C. §1344, 40 CFR 230 and 231

Because OU-2 Alternative 3 does not involve trucking contaminated soil or slag into or out of the Site and requires the least amount of grading and therefore the least amount of potential exposure to workers and the general public, the short-term effectiveness of this alternative is high in comparison to the other slag pile alternatives. The primary considerations for short-term effectiveness are protection of the community, workers, and environmental impacts both during and after implementation. This alternative involves excavation, grading, material transfer, stockpile development/management, and site restoration activities. Heavy equipment would be used to clear and grub, excavate, transfer, load, and grade impacted materials. Potential exposure and protection procedures for workers engaged in these activities would be addressed in detail under a Site safety and health plan. During excavation and material handling activities, measures would be taken to reduce fugitive dust emissions and associated impacts to workers. Water would be imported for dust control, and workers in the controlled area would don the appropriate safety equipment and implement safety practices such as air monitoring. Work areas would be secured (i.e., marked or fenced) to ensure access by authorized personnel only.

Long-term effectiveness of this alternative is high. Since contaminated slag would be appropriately capped, potential exposure reductions to those accessing the Site would be permanent. In addition, long-term ICs would increase awareness of contaminants and minimize potential exposure to contaminated soils at the Site.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.7.2 Implementability

OU-2 Removal Alternative 3 rates medium in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the consolidation, grading, capping and associated activities. The slag pile sites are also readily accessible. Consolidation, grading, and capping would be scheduled and performed in a manner that ensures worker and public safety. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors. However, because of the bank stabilization work in Eureka Creek, it would require procurement of and compliance with a permit from the USACE in accordance with Section 404 of the Clean Water Act. These permits typically take 2-4 years to obtain and require ongoing monitoring once the action is completed.

The consolidation and grading of contaminated material would be accomplished using a variety of conventional equipment. Heavy equipment needed for this project such as scrapers, excavators, dozers, loaders, compactors and/or bulk carriers are commercially available. Working space is available for establishing temporary construction office trailers. Electricity is already available at the Site and portable sanitary services and refuse disposal are locally available. Construction materials (e.g., backfill, rip rap) for capping and site restoration activities are commercially available. Off-site water would be required for construction water and is readily accessible. On-site and off-site laboratories for sample analyses are readily available.

Trained and experienced labor is available for site work activities. Special certifications and training requirements are commercially available. Health and safety training to comply with OSHA regulations, including hazardous material handling training is available. Cultural resource liaisons are commercially available. Site-specific ICs are readily available based on former EPA experience at comparable sites throughout the western U.S.

9.7.3 Cost

The estimated NPV of OU-2 Removal Alternative 3 is $3,550,000. This alternative would not have any corresponding disposal costs as does Alternative 1. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness, short-term effectiveness, and permanence are high. The cost for Alternative 3 is lower in comparison to Alternatives 4 and 5, which also propose capping the slag in place. However, because this alternative does nothing to minimize the size/volume of a locally constructed repository or otherwise minimize the amount of soil/slag that would potentially need to be disposed of elsewhere, and Alternatives 4 and 5 do, the cost-effectiveness of Alternative 3 is low.

9.8 OU-2 REMOVAL ALTERNATIVE 4 ANALYSIS – LIMITED USE OF RCS AND/OR ECS SLAG PILES AS CONSOLIDATED WASTE REPOSITORIES; GRADING AND IN-PLACE CAPPING OF SLAG PILES WITH A 2-FOOT SOIL COVER; AND ICs

Implementation of OU-2 Removal Alternative 4, limited use of RCS and/or ECS slag piles as consolidated waste repository areas; grading and in-place capping of slag piles with 2 feet of soil cover; and, ICs would require the following steps:

- Limited consolidation of approximately 5,000 CY of wastes generated from OU-1, OU-2, OU-3, and/or OU-4 to fill in existing holes, voids, and low-lying areas at the RCS and/or ECS. This would likely include consolidation of the Matamoras and or the Atlas Slag piles.
- Grading utilized slag pile(s) slopes to less than 3:1 H:V.

- Capping utilized slag pile(s) using either 2 feet of compacted clean fill, or a HDPE geomembrane liner and then 2 feet of compacted clean fill.
- Import clean fill as necessary to establish grades and surface water drainage patterns.
- Excavate portions of adjacent surface water drainage(s) and stabilize with rip rap and potentially a HDPE liner to reduce erosion.
- Implement ICs for the Site.

9.8.1 Effectiveness

The effectiveness of OU-2 Removal Alternative 4 is considered high for achieving the RAOs. This alternative would significantly minimize potential exposure to highly contaminated slag materials and contaminated soils at the Site. This alternative would provide control of slag and soil concentrations, mobility, and a reduction in risk to human health and the environment at the Site. Potential limited exposures during excavation, transport, and at the final disposal site would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037
- Surface Water (Federal) – CWA 33 U.S.C. §1342; NPDES 40 CFR Parts 122 and 125; U.S.C. §1344, 40 CFR 230 and 231

Short-term effectiveness of this alternative is medium because of the disturbance of the contaminated slag and soil wastes and the importation of a limited amount of other contaminated material. The primary considerations for short-term effectiveness are protection of the community, workers, and environmental impacts both during and after implementation. This alternative involves excavation, material transfer, stockpile development/management, loading of bulk carriers, and site restoration activities. Heavy equipment would be used to clear and grub, excavate, transfer, load, and grade impacted materials. Potential exposure and protection procedures for workers engaged in these activities would be addressed in detail under a Site safety and health plan. During excavation and material handling activities, measures would be taken to reduce fugitive dust emissions and associated impacts to workers. Water would be imported for dust control, and workers in the controlled area would don the appropriate safety equipment and implement safety practices such as air monitoring. Work areas would be secured (i.e., marked or fenced) to ensure access by authorized personnel only.

Long-term effectiveness of this alternative is high. Since contaminated slag and soils would be excavated, removed, and appropriately capped, potential exposure reductions to those accessing the Site would be permanent. In addition, long-term ICs would increase awareness of contaminants and minimize potential exposure to contaminated soils at the Site.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.8.2 Implementability

OU-2 Removal Alternative 4 rates medium in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the consolidation, grading, capping and associated activities. However, because of the necessary bank stabilization work within Eureka Creek, it would require a Section 404 Permit and a limited amount of trucking of waste within the Town of Eureka.

The slag pile sites are readily accessible. Consolidation, grading, and capping would be scheduled and performed in a manner that ensures worker and public safety. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors.

The consolidation and grading of contaminated material would be accomplished using a variety of conventional equipment. Heavy equipment needed for this project such as scrapers, excavators, dozers, loaders, compactors and/or bulk carriers are commercially available. Working space is available for establishing temporary construction office trailers. Electricity is readily available at the Site and portable sanitary services and refuse disposal are locally available. Construction materials (e.g., backfill, rip rap) for capping and site restoration activities are commercially available. Off-site water would be required for construction water and is readily accessible. On-site and off-site laboratories for sample analyses are readily available.

Trained and experienced labor is available for site work activities. Special certifications and training requirements are commercially available. Health and safety training to comply with OSHA regulations, including hazardous material handling training is available. Cultural resource liaisons are commercially available. Site-specific ICs are readily available based on former EPA experience at comparable sites throughout the western U.S.

9.8.3 Cost

The estimated NPV of OU-2 Removal Alternative 4 is $3,640,000. This alternative would not have any corresponding disposal costs as does Alternative 1. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence are high while the short-term effectiveness is medium. The cost for Alternative 4 is lower in comparison to Alternative 5, which also proposes capping the slag in place. However, because this alternative only marginally minimizes the size/volume of a locally constructed repository or otherwise minimizes the amount of soil/slag that would potentially need to be disposed of elsewhere, and Alternative 5 significantly minimizes the disposal of soil/slag elsewhere, the cost-effectiveness of Alternative 4 is medium.

9.9 OU-2 REMOVAL ALTERNATIVE 5 ANALYSIS – MAXIMIZED USE OF RCS AND/OR ECS SLAG PILES AS CONSOLIDATED WASTE REPOSITORY AREAS; GRADING AND IN-PLACE CAPPING OF SLAG PILES WITH A 2-FOOT SOIL COVER; AND ICS

Implementation of OU-2 Removal Alternative 5, maximized use of RCS and/or ECS slag piles as consolidated waste repositories; grading and in-place capping of slag piles with 2 feet of soil cover; and ICs would require the following steps:

- Maximized consolidation of approximately 26,000 CY of wastes generated from OU-1, OU-2, OU-3, and/or OU-4 to fill in existing holes, voids, and low-lying areas at the RCS and/or ECS. This would likely include consolidation of the Matamoras and/or the Atlas Slag piles.
- Grading utilized slag pile(s) slopes to less than 3:1 H:V.
- Capping utilized slag pile(s) using either 2 feet of compacted clean fill, or a HDPE geomembrane liner and then 2 feet of compacted clean fill.
- Import clean fill as necessary to establish grades and surface water drainage patterns.
- Excavate portions of adjacent surface water drainage(s) and stabilize with rip rap and potentially a HDPE liner to reduce erosion.
- Implement ICs for the Site.

9.9.1 Effectiveness

The effectiveness of OU-2 Removal Alternative 5 is considered high for achieving the RAOs. This alternative would significantly minimize potential exposure to highly contaminated slag materials and contaminated soils at the Site. This alternative would provide control of slag and soil concentrations, mobility, and a reduction in risk to human health and the environment at the Site. Potential limited exposures during excavation, transport, and at the final disposal site would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)

- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037
- Surface Water (Federal) – CWA 33 U.S.C. §1342; NPDES 40 CFR Parts 122 and 125; U.S.C. §1344, 40 CFR 230 and 231

This alternative involves excavation, material transfer, stockpile development/management, loading of bulk carriers, and Site restoration activities. Heavy equipment would be used to clear and grub, excavate, transfer, load, and grade impacted materials. Potential exposure and protection procedures for workers engaged in these activities would be addressed in detail under a Site safety and health plan. During excavation and material handling activities, measures would be taken to reduce fugitive dust emissions and associated impacts to workers. Water would be imported for dust control, and workers in the controlled area would don the appropriate safety equipment and implement safety practices such as air monitoring. Work areas would be secured (i.e., marked or fenced) to ensure access by authorized personnel only.

The primary considerations for short-term effectiveness are protection of the community, workers, and environmental impacts both during and after implementation. Short-term effectiveness of OU-2 Alternative 5 is low because of the increased disturbance of the contaminated slag and soil wastes and because it includes the highest import volume of contaminated material of any of the three OU-2 alternative that involve closing the slag piles in place (i.e., OU-2 Alternatives 3 through 5). Additionally, interring an additional 26,000 CY of material on the RCS and ECS slag piles would likely require additional engineering and construction of retaining wall structures, rock gabion baskets, constructed channels, culverts, and or other measures intended to retain and stabilize the additional material. The importation of the additional material and the construction of these structures would increase the short-term disturbance to residents and the period during which workers and the general public could potentially be exposed to contaminants.

Long-term effectiveness of this alternative is high. Since contaminated slag and soils would be excavated, removed, and appropriately capped, potential exposure reductions to those accessing the Site are considered permanent. In addition, long-term ICs would increase awareness of contaminants and minimize potential exposure to contaminated soils at the Site.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.9.2 Implementability

Except for the No-Action alternative, OU-2 Removal Alternative 5 rates the lowest for technical and administrative implementability since it requires the greatest degree of engineering and design work and due to the necessary construction of retaining walls and similar engineered structural components that other OU-2 alternatives don’t require. For the ECS pile, some of the additional construction may need to occur within the U.S. Highway 50 right-of way, which creates additional administrative requirements. However, these structures are conventional in nature and the slag pile sites are generally readily accessible. Additionally, it would also likely require a procurement of a Section 404 Permit, including the associated hydraulic and hydrologic modeling. Consolidation, grading, and capping would be scheduled and performed in a manner that ensures worker and public safety. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors.

The consolidation and grading of contaminated material would be accomplished using a variety of conventional equipment. Heavy equipment needed for this project such as scrapers, excavators, dozers, loaders, compactors and/or bulk carriers are commercially available. Working space is available for establishing temporary construction office trailers. Electricity is readily available at the Site and portable sanitary services and refuse disposal are locally available. Construction materials (e.g., backfill, rip rap) for capping and Site restoration activities are commercially available. Off-site water would be required for construction water and is readily accessible. On-site and off-site laboratories for sample analyses are readily available.

Trained and experienced labor is available for site work activities. Special certifications and training requirements are commercially available. Health and safety training to comply with OSHA regulations, including hazardous material handling training is available. Cultural resource liaisons are commercially available. Site-specific ICs are readily available based on former EPA experience at comparable sites throughout the western U.S.

9.9.3 Cost

The estimated NPV of OU-2 Removal Alternative 5 is $5,450,000. This alternative would not have any corresponding disposal costs as does Alternative 1. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence are high while the short-term effectiveness is low. The cost for Alternative 5 is higher in comparison to Alternatives 3 and 4, which also propose capping the slag in place. However, because this alternative significantly minimizes the size/volume of a locally constructed repository or the amount of soil/slag that would potentially need to be disposed of elsewhere, and Alternatives 3 and 4 only marginally minimize the disposal of soil/slag elsewhere, the cost-effectiveness of Alternative 5 is high in comparison to the other alternatives.

9.10 OU-3 REMOVAL ALTERNATIVE 2 – SMELTER AND MILL FOOTPRINT AREA 1-FOOT SOIL EXCAVATION AND REMOVAL WITH 1-FOOT SOIL AND/OR ROCK COVER ON >10% SLOPES; AND ICS

Implementation of OU-3 Removal Alternative 2, smelter and mill footprint area 1-foot soil excavation and removal with 1-foot soil and/or rock cover on >10% slopes, and ICs would require the following steps:

- Excavate 1 foot of contaminated soil at undeveloped land parcels identified within OU-3.
- Cover, grading and Site restoration at OU-3 excavation areas with 1 foot of clean fill in relatively level areas.

- Cover excavated areas that exceed approximately 10% slope with clean imported 4-inch to 8-inch rock.
- Implement ICs for the Site.

9.10.1 Effectiveness

The effectiveness of OU-3 Removal Alternative 2 is considered high for achieving the RAOs. This alternative would significantly minimize potential exposure to contaminated soils at the Site. This alternative would provide control of soil concentrations, mobility, and a reduction in risk to human health and the environment at the Site. Potential limited exposures during excavation, transport, and at the final disposal site would be managed through engineering controls and PPE. However, the workers, residents, and community members would be subject to increased, dust levels, traffic, and emissions from passenger vehicles, heavy equipment, and trucks. Therefore, a medium level of short-term protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037

The primary considerations for short-term effectiveness are protection of the community, workers, and environmental impacts both during and after implementation. This alternative involves excavation, material transfer, stockpile development/management, loading of bulk carriers, and Site restoration activities. The short-term effectiveness of this alternative is considered low because of the large area of excavation on steep slopes and the large volume of trucking required would require the greatest amount of trucking and equipment time, and therefore the greatest amount of fossil fuel use and impact to the community. Heavy equipment would be used to clear and grub, excavate, transfer, load, and grade impacted materials. Potential exposure and protection procedures for workers engaged in these activities would be addressed in detail under a Site health and safety plan. During excavation and material handling activities, measures would be taken to reduce fugitive dust emissions and associated impacts to workers. Water would be imported for dust control, and workers in the controlled area would don the appropriate safety equipment and implement safety practices such as air monitoring. Work areas would be secured (e.g., marked or fenced) to ensure access by authorized personnel only.

Long-term effectiveness of this alternative is high. Since contaminated soils would be excavated and removed, potential exposure reductions to those accessing the Site would be permanent. In addition, long-term ICs would increase awareness of contaminants and minimize potential exposure to contaminated soils at the Site.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.10.2 Implementability

OU-3 Removal Alternative 2 rates low in technical and administrative implementability. Although it is technically feasible and would utilize conventional equipment, materials, or labor for the clearing, grubbing, excavation, and backfill with rock slope protection, the steep slopes in many of the identified OU-3 land parcels are not readily accessible to conventional excavation and hauling equipment (i.e., trucks). Because many of the parcels are steeply sloped, excavation and backfill in those areas can be difficult. Whenever possible, excavation would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety; however, because of the steep slopes some material may have to be handled twice, both during excavation work and during backfill with rock slope protection. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors.

The excavation of contaminated material would be accomplished using a variety of conventional and specialized equipment (e.g., long-reach excavators). Heavy equipment needed for this project such as scrapers, excavators, dozers, loaders, compactors and/or bulk carriers are commercially available. Working space is available for establishing temporary construction office trailers. Electricity is readily available at the Site and portable sanitary services and refuse disposal are locally available. Construction materials (e.g., backfill and rock) for capping/covering and site restoration activities are commercially available. Off-site water would be required for construction water and is readily accessible. On-site and off-site laboratories for sample analyses are readily available.

Trained and experienced labor is available for site work activities. Special certifications and training requirements are commercially available. Health and safety training to comply with OSHA regulations, including hazardous material handling training is available. Cultural resource liaisons are commercially available. Site-specific ICs are readily achievable based on former EPA experience at comparable sites throughout the western U.S.

9.10.3 Cost

The estimated NPV of OU-3 Removal Alternative 2, excluding disposal, is $4,640,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence are high while the short-term effectiveness is low. The cost for Alternative 2 is higher in comparison to Alternative 3, which also achieves the RAOs at OU-3. In addition, Alternative 2 has an increased excavation and disposal volume of over 27,000 CY versus Alternative 3, which greatly increases the disposal costs for Alternative 2. Therefore, the cost-effectiveness of Alternative 2 is low.

9.11 OU-3 REMOVAL ALTERNATIVE 3 – SMELTER AND MILL FOOTPRINT AREA SLOPE CAPPING WITH 1 FOOT OF ROCK (ROCK SLOPE PROTECTION); LIMITED 1-FOOT SOIL EXCAVATION AND REMOVAL WITH 1-FOOT SOIL CAP IN RESIDENTIAL AREAS; AND ICs

Implementation of OU-3 Removal Alternative 3, smelter and mill footprint area slope capping with 1 foot of rock (rock slope protection); limited 1-foot soil excavation and removal with 1-foot soil cap in residential areas; and ICs would require the following steps:

- Primarily cover areas identified in OU-3 with 1 foot of 4-inch to 8-inch rock.
- Limited 1-foot excavation of contaminated soil at planned residential areas within OU-3.
- Cover, grading, and Site restoration at excavated OU-3 areas with 1 foot of clean fill in relatively level areas, or with a minimum of 1 foot of clean imported 4-inch to 8-inch rock in areas where slopes exceed approximately 10%.
- Implement ICs for the Site.

9.11.1 Effectiveness

The effectiveness of OU-3 Removal Alternative 3 is considered high for achieving the RAOs. This alternative would minimize potential exposure to contaminated soils at the Site. This alternative would provide control of soil concentrations, mobility, and a reduction in risk to human health and the environment at the Site. Potential limited exposures during excavation, transport, and at the final disposal site would be managed through engineering controls. Therefore, a medium level of short-term protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037

Short-term effectiveness of this alternative is medium because of the disturbance of the contaminated soil waste. The primary considerations for short-term effectiveness are protection of the community, workers, and environmental impacts both during and after implementation.

This alternative involves excavation, material transfer, stockpile development/management, loading of bulk carriers, and Site restoration activities. Heavy equipment would be used to clear and grub, excavate, transfer, load, and grade impacted materials. Potential exposure and protection procedures for workers engaged in these activities would be addressed in detail under a Site health and safety plan. During excavation and material handling activities, measures would be taken to reduce fugitive dust emissions and associated impacts to workers. Water would be imported for dust control, and workers in the controlled area would don the appropriate safety equipment and implement safety practices such as air monitoring. Work areas would be secured (e.g., marked or fenced) to ensure access by authorized personnel only.

Long-term effectiveness of this alternative is high. Since contaminated soils would be covered, excavated and removed, the potential exposure reductions to those accessing the Site would be permanent. In addition, long-term ICs would increase awareness of contaminants and minimize potential exposure to contaminated soils at the Site.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.11.2 Implementability

OU-3 Removal Alternative 3 rates medium in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities. The identified OU-3 land parcels are also readily accessible; however, some parcels are steeply sloped and clearing, grubbing and placing rock on steep slopes can be technically difficult. To the extent possible, excavation and capping activities would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. However, as with OU-3 Alternative 2, some rock slope protection materials may need to be handled twice. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors.

The excavation of contaminated material would be accomplished using a variety of conventional equipment. Heavy equipment needed for this project such as scrapers, excavators, dozers, loaders, compactors and/or bulk carriers are commercially available. Working space is available for establishing temporary construction office trailers. Electricity is readily available at the Site and portable sanitary services and refuse disposal are locally available. Construction materials (e.g., backfill and rock) for capping/covering and site restoration activities are commercially available. Off-site water would be required for construction water and is readily accessible. On-site and off-site laboratories for sample analyses are readily available.

Trained and experienced labor is available for site work activities. Special certifications and training requirements are commercially available. Health and safety training to comply with OSHA regulations, including hazardous material handling training is available. Cultural resource liaisons are commercially available. Site-specific ICs are readily achievable based on former EPA experience at comparable sites throughout the western U.S.

9.11.3 Cost

The estimated NPV of OU-3 Removal Alternative 3, excluding disposal, is $3,850,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence are high while the short-term effectiveness is medium. The cost for Alternative 3 is lower in comparison to Alternative 2, which also achieves the RAOs at OU-3. However, Alternative 3 has significantly less excavation and disposal volume (over 27,000 CY), which greatly decreases the disposal costs for Alternative 3 versus Alternative 2. Therefore, the cost-effectiveness of Alternative 3 is the highest of the three OU-3 alternatives considered.

9.12 OU-4 REMOVAL ALTERNATIVE 2 – LIMITED EXCAVATION AND REMOVAL OF 1.5 FEET OF SOIL/SEDIMENTS; AND RIP RAP ARMORING

Implementation of OU-4 Removal Alternative 2, limited excavation and removal of 1.5 feet of soil/sediments and rip rap armoring includes the following steps:

- Excavation of 1.5 feet of contaminated sediment below the existing channel of Eureka Creek not already covered with rip rap.
- Capping the excavated channel with an 18-inch thick layer of 12-inch nominal diameter rip rap.
- Implementation of sediment and erosion control measures during removal implementation, to include as necessary, sediment basins or diversion channels.

9.12.1 Effectiveness

The effectiveness of OU-4 Removal Alternative 2 is considered medium for achieving the RAOs. This alternative would minimize potential exposure to contaminated sediment at the Site and provide a significant reduction in further migration of contaminated sediment downstream. This alternative would also provide significant reduction in the potential release of lead and arsenic from sediment to surface water. Potential limited exposures during excavation, transport, and off-loading at the final disposal site would be managed through engineering controls. However, some contaminants may remain in sediments deeper than 1.5 feet below the channel bottom, and these sediment may become partially re-distributed during large flood events. Therefore, a medium level of protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)

- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037
- Surface Water (Federal) – CWA 33 U.S.C. §1342; NPDES 40 CFR Parts 122 and 125; U.S.C. §1344, 40 CFR 230 and 231
- Surface water (Nevada) – NAC § 445A.121; § 4451.122

Short-term effectiveness of this alternative is low because of the large amount of disturbance of the riparian habitat and relatively large impact to residents (there are numerous houses that border Eureka Creek, as shown in Figure 16) and the community. The primary considerations for short-term effectiveness are protection of Eureka Creek downstream of the removal action, the community, workers, and other environmental impacts both during and after implementation. This alternative involves excavation, material transfer, stockpile development/management, loading of bulk carriers, disposal, and Site restoration activities. Heavy equipment would be used to clear and grub, excavate, transfer, load, and grade impacted materials. Potential exposure and protection procedures for workers engaged in these activities would be addressed in detail under a Site health and safety plan. During excavation and material handling activities, measures would be taken to reduce sediment migration downstream and associated impacts to workers. Erosion and run off controls would be implemented at excavated sediment stockpiles to prevent any discharges from saturated sediment. Water would be imported for dust control as needed to ensure stockpiles remain sufficiently moist to prevent fugitive dust emissions. Workers in the controlled area would don the appropriate safety equipment and implement safety practices such as air monitoring. Work areas would be secured (e.g., marked or fenced) to ensure access by authorized personnel only.

This alternative is expected to effectively mitigate the short-term effects on potential human and ecological receptors at the Site. However, the ability to maintain that protection is dependent on preventing it from being re-contaminated. If contamination in other portions of the Town of Eureka are not addressed and/or remain contaminated, runoff from these areas could re-introduce contaminants to Eureka Creek. Therefore, the long-term effectiveness of this alternative is medium.

9.12.2 Implementability

OU-4 Removal Alternative 2 rates medium in technical and administrative implementability. It is technically feasible and would utilize conventional techniques, materials, and labor for the excavation and associated activities and the identified impacted areas of Eureka Creek are generally accessible. However, it would likely require procurement of, and compliance with, the substantive portions of a Section 404 Permit, including the associated hydraulic and hydrologic modeling, and post-removal monitoring. Additionally, work might be limited to dry weather periods, and/or require the construction of cofferdams and pumping systems that bypass surface water around construction areas. Excavation would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Sediment and erosion controls, and fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors.

The excavation of contaminated material would be accomplished using a variety of conventional equipment. Heavy equipment needed for this project such as scrapers, excavators, dozers, loaders, pumps, piping, diversion dams, compactors and/or bulk carriers are commercially available. Working space is available for establishing temporary construction office trailers. Electricity is already available at the Site and portable sanitary services and refuse disposal are locally available. Construction materials (e.g., rip rap) for capping/covering and site restoration activities are commercially available. Off-site water would be required for construction water and is readily accessible. On-site and off-site laboratories for sample analyses are readily available.

Trained and experienced labor is available for site work activities. Special certifications and training requirements are commercially available. Health and safety training to comply with OSHA regulations, including hazardous material handling training is available. Cultural resource liaisons are commercially available.

9.12.3 Cost

The estimated NPV of OU-4 Removal Alternative 2, excluding disposal, is $3,238,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence are medium while the short-term effectiveness is low. The cost for Alternative 2 is lower in comparison to Alternative 3, which also achieves the RAOs at OU-4. Alternative 2 has a significantly less excavation and disposal volume versus Alternative 3, which greatly decreases the disposal costs for Alternative 2. Therefore the cost-effectiveness of Alternative 2 is medium.

9.13 OU-4 REMOVAL ALTERNATIVE 3 – EXCAVATION AND REMOVAL OF 2.5 FEET OF SOIL/SEDIMENTS; IN-PLACE CAPPING WITH 1 FOOT OF CLEAN FILL; AND RIP RAP ARMORING

Implementation of OU-4 Removal Alternative 3, limited excavation and removal of 2.5 feet of soil/sediments; in-place capping with clean fill, and rip rap armoring includes the following steps:

- Excavation of 2.5 feet of contaminated sediment below the existing channel of Eureka Creek not already covered with rip rap.
- Placement of 1 foot of clean imported fill would be placed over the excavated area, and compacted.
- Capping the excavated channel with an 18-inch thick layer of 12-inch nominal diameter rip rap.
- Implementation of sediment and erosion control measures during removal implementation, to include as necessary, sediment basins or diversion channels.

9.13.1 Effectiveness

The effectiveness of OU-4 Removal Alternative 3 is considered medium for achieving the RAOs. This alternative would minimize potential exposure to contaminated sediment at the Site and provide a significant reduction in further migration of contaminated sediment downstream. This alternative would also provide significant reduction in the potential release of lead and arsenic from sediment to surface water. Potential limited exposures during excavation, transport, and at the final disposal site would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative. However, very large magnitude flood events may still mobilize any residual contaminants.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037
- Surface Water (Federal) – CWA 33 U.S.C. §1342; NPDES 40 CFR Parts 122 and 125; U.S.C. §1344, 40 CFR 230 and 231
- Surface water (Nevada) – NAC § 445A.121; § 4451.122

Short-term effectiveness of this alternative is the lower of the two action alternatives because it involves the greatest loading, hauling, and disposal of the contaminated sediment. The primary considerations for short-term effectiveness are protection of Eureka Creek downstream of the removal action, the community, workers, and other environmental impacts both during and after implementation. This alternative involves excavation, material transfer, stockpile development/management, loading of bulk carriers, and site restoration activities. Heavy equipment would be used to clear and grub, excavate, transfer, load, and grade impacted materials. Potential exposure and protection procedures for workers engaged in these activities would be addressed in detail under the Site health and safety plan. During excavation and material handling activities, measures would be taken to reduce sediment migration downstream and associated impacts to workers. Erosion and run off controls would be implemented at excavated sediment stockpiles to prevent any discharges from saturated sediment. Water would be imported for dust control as needed to ensure stockpiles remain sufficiently moist to prevent fugitive dust emissions. Workers in the controlled area would don the appropriate safety equipment and implement safety practices such as air monitoring. Work areas would be secured (e.g., marked or fenced) to ensure access by authorized personnel only.

This alternative is expected to effectively mitigate the short-term effects on potential human and ecological receptors at the Site. However, the ability to maintain that protection is dependent on preventing it from being re-contaminated. If contamination in other portions of the Town of Eureka are not addressed and/or remain contaminated, runoff from these areas could re-introduce contaminants to Eureka Creek. Therefore, similar to OU-4 Alternative 2, the long-term effectiveness of this alternative is medium.

9.13.2 Implementability

OU-4 Removal Alternative 3 rates medium in technical and administrative implementability. It is technically feasible and would utilize conventional techniques, materials, and labor for the excavation and associated activities and the identified impacted areas of Eureka Creek are generally accessible. However, it would likely require procurement of, and compliance with, the substantive portions of a Section 404 Permit, including the associated hydraulic and hydrologic modeling, and post-removal monitoring. Additionally, work might be limited to dry weather periods, and/or require the construction of cofferdams and pumping systems that bypass surface water around construction areas. Excavation would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Sediment and erosion controls, and fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors.

The excavation of contaminated material would be accomplished using a variety of conventional equipment. Heavy equipment needed for this project such as scrapers, excavators, dozers, loaders, compactors and/or bulk carriers are commercially available. Working space is available for establishing temporary construction office trailers. Electricity is already available at the Site and portable sanitary services and refuse disposal are locally available. Construction materials (e.g., rip rap) for capping/covering and site restoration activities are commercially available. Off-site water would be required for construction water and is readily accessible. On-site and off-site laboratories for sample analyses are readily available.

Trained and experienced labor is available for site work activities. Special certifications and training requirements are commercially available. Health and safety training to comply with OSHA regulations, including hazardous material handling training is available. Cultural resource liaisons are commercially available.

9.13.3 Cost

The estimated NPV of OU-4 Removal Alternative 3, excluding disposal, is $3,810,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence are medium while the short-term effectiveness is low. The cost for Alternative 3 is higher in comparison to Alternative 2, which also achieves the RAOs at OU-4. Alternative 3 has a significantly greater excavation and disposal volume versus Alternative 2, which greatly increases the disposal costs for Alternative 3. Therefore the cost-effectiveness of Alternative 3 is low.

9.14 OU-5 DISPOSAL ALTERNATIVE 1 – OFFSITE DISPOSAL OF REMOVAL WASTE AT AN EXISTING LANDFILL

Implementation of OU-5 Alternative 1 would include loading and hauling of up to 61,900 CY of hazardous material and 137,500 CY of non-hazardous contaminated material generated from the Site to an existing landfill facility (or facilities) permitted to receive the respective material. To prevent leachable metals from discharging from the waste, the estimated 61,900 CY of assumed hazardous material (slag) generated from the Site would require crushing and stabilization prior to disposal.

9.14.1 Effectiveness

The effectiveness of OU-5 Removal Alternative 1 is considered high for achieving the RAOs. This alternative would permanently eliminate the potential exposure to contaminated materials at the Site. Potential limited exposures during excavation, transport, crushing, stabilization, and at the final disposal site would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037

This alternative involves the most material transfer, stockpile development/management, loading of bulk hazardous material carriers, truck traffic, fossil fuel use, and site restoration activities. Heavy equipment would be used to clear and grub (as needed), excavate, transfer, load, and grade impacted materials. Bulk carriers hauling the containerized wastes off-site would be covered, secured, and weighed to document compliance with total and axle load limits. Truck traffic would be coordinated under a transportation plan for routes, times of operation, and on-site traffic rules. Emergency spill containment and cleanup contingency actions would also be included in the transportation plan to address material spills. Due to the large volume of material (approximately 11,500 truckloads of soil and slag), all actions not being performed concurrently, and the long drive to the disposal facility, it is estimated that the disposal actions described in OU-5 Alternative 1 could be completed in four construction seasons (April through November). Table B-13 Assumes four seasons for the purpose of cost estimating. Because it is considered administratively and technically simple, 1 year of planning, design, and permitting was estimated.

Since none of the existing permitted landfills are located within 4 hours drive time of the Site, this alternative also has the highest amount of trucking and heavy equipment use in total vehicle hours. For example, at an assumed weight of 24 tons per truckload and an operated vehicle time of 10 hours per load, the estimated 11,500 truckloads of contaminated slag and soil would necessitate an expenditure of approximately 115,000 hours of vehicle run time for disposal. In comparison, the estimated vehicle run time for OU-5 Alternative 2 (i.e., hauling only slag for disposal) is estimated to reduce the amount of truck hours required by approximately 46,700 hours. This estimate assumes that soil from the other OUs is disposed of within the Town of Eureka.

Based on these estimates, OU-5 Alternative 1 has the highest potential for additional vehicular accidents, increased wear and tear on infrastructure (streets, bridges, and highways), produces the highest amount of air pollution (from particulate matter and oxides in vehicle exhaust), traffic closures and associated inconvenience to the general public, and uses the greatest amount of fossil fuels. Because of the large number of hours of equipment operation, and the associated potentially noisy crushing and stabilization operations required, which also potentially expose workers to more respirable forms of lead and arsenic than any other alternative, Alternative 1 is ranked the lowest of the four OU-5 alternatives in short-term effectiveness. Long-term effectiveness of this alternative is high. Since contaminated slag and soils would be excavated, removed, and appropriately disposed, potential exposure reductions to those accessing the Site would be permanent.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.14.2 Implementability

OU-5 Removal Alternative 1 rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities. The excavation and stockpile sites are also readily accessible. Hauling would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to the general public and sensitive receptors. Profiling and manifesting of the material would be done in coordination with the transporters and off-site disposal facility.

9.14.3 Cost

The NPV of OU-5 Removal Alternative 1 is estimated to be $37,190,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence are high, while the short-term effectiveness is low. Because the cost is approximately $12M more than Alternative 2, is 600% to 1,100% more than Alternatives 3A and 3B, and provides only a slight increase in the level of protection, the cost-effectiveness of Alternative 1 is very low.

9.15 OU-5 DISPOSAL ALTERNATIVE 2 – DISPOSAL OF SOIL AT A LOCALLY CONSTRUCTED LANDFILL, AND OFF-SITE DISPOSAL OF SLAG PILES AT AN EXISTING LANDFILL FACILITY

Implementation of OU-5 Alternative 2 would include crushing, stabilization, loading, and hauling of up to 61,900 CY of hazardous material to a RCRA Subtitle C hazardous waste landfill. It also includes hauling and disposing up to 137,500 CY of non-hazardous contaminated material at a repository constructed within the Town of Eureka.

9.15.1 Effectiveness

The effectiveness of OU-5 Removal Alternative 2 is considered high for achieving the RAOs. This alternative would permanently eliminate the potential exposure to contaminated materials at the Site. Potential limited exposures during excavation, transport, crushing, stabilization, and at the final disposal sites would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037

This alternative involves the second greatest amount of material transfer, stockpile development/management, loading of bulk hazardous material carriers, truck traffic, fossil fuel use, and site restoration activities of any of the disposal alternatives. Heavy equipment would be used to crush and stabilize slag, then transfer, load, and haul impacted materials. Bulk carriers hauling the containerized wastes off-site would be covered, secured, and weighed to document compliance with total and axle load limits. Truck traffic would be coordinated under a transportation plan for routes, times of operation, and on-site traffic rules. Emergency spill containment and cleanup contingency actions would also be included in the transportation plan to address material spills. Due to the large volume of material (approximately 11,500 truckloads of soil and slag), not all actions being performed concurrently, and the long drive to the disposal facility, it is estimated that the disposal actions described in OU-5 Alternative 2 could be completed in four construction seasons (April through November). Table B-14 Assumes four seasons for the purpose of cost estimating. Because it is considered administratively and technically simple, 1 year of planning, design, and permitting was estimated.

Since none of the existing permitted landfills are located within 4 hours drive time of the Site, this alternative also has the second highest amount of trucking and heavy equipment use in total vehicle hours. For example, at an assumed weight of 24 tons per truckload and an operated vehicle time of 10 hours per load, the estimated 3,800 truckloads of slag would necessitate an expenditure of approximately 38,000 hours of vehicle run time for disposal. In comparison, the estimated vehicle run time for OU-5 Alternative 3 (i.e., hauling only soil from OUs 1, 3, and 4 for disposal) is estimated to require only 6,450 hours of trucking. This estimate assumes that soil from the other three OUs is disposed of within the Town of Eureka.

Based on these estimates, OU-5 Alternative 2 has the second highest potential for additional vehicular accidents, increased wear and tear on infrastructure (streets, bridges, and highways), produces the second greatest amount of air pollution (from particulate matter and oxides in vehicle exhaust), traffic closures and associated inconvenience to the general public, and uses the greatest amount of fossil fuels. Because of the large number of hours of equipment operation, and the associated potentially noisy crushing and stabilization operations required, which also potentially expose workers to more respirable forms of lead and arsenic than Alternatives 3A or 3B, Alternative 2 is ranked the second lowest of the four OU-5 alternatives in short-term effectiveness. Long-term effectiveness of this alternative is high. Since contaminated slag and soils would be excavated, removed, and appropriately disposed, potential exposure reductions to those accessing the Site would be permanent.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.15.2 Implementability

OU-5 Removal Alternative 2 rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities. The excavation and stockpile sites are also readily accessible. Hauling would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to the general public and sensitive receptors. Profiling and manifesting of the material would be done in coordination with the transporters and off-site disposal facility.

9.15.3 Cost

The NPV of OU-5 Removal Alternative 2 is estimated to be $27,270,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence are high while the short-term effectiveness is low. Because the cost is over 400% more than Alternative 3A, approximately 784% more than Alternative 3B, and provides a similar level of protection, the cost-effectiveness of Alternative 2 is low.

9.16 OU-5 DISPOSAL ALTERNATIVE 3A – DISPOSAL OF MAXIMUM ESTIMATED SOIL FROM OU-1, OU-3, AND OU-4 AT A LOCALLY CONSTRUCTED LANDFILL

Implementation of OU-5 Alternative 3A would include:

- Construction of a soil repository within the Town of Eureka including lined channels, temporary and permanent caps, storm water controls, etc.
- Loading and hauling contaminated soil from OUs 1, 3, and 4 to the repository over several construction seasons.
- Temporary traffic control measures during periods of high-volume hauling.
- Grading, capping, and site restoration work on the repository area.
- Implement ICs for the repository area.

9.16.1 Effectiveness

The effectiveness of OU-5 Removal Alternative 3A is considered high for achieving the RAOs. This alternative would permanently eliminate the potential exposure to contaminated materials at the Site. Potential limited exposures during excavation, transport, crushing, stabilization, and at the final disposal sites would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037

This alternative involves a low to medium amount of material transfer, stockpile development/management, loading of bulk hazardous material carriers, truck traffic, fossil fuel use, and site restoration activities in comparison to OU-5 Alternatives 1 and 2. Bulk carriers hauling the waste from the excavation area to the repository would be covered and secured prior to transport. Truck traffic would be coordinated under a transportation plan for routes, times of operation, and on-site traffic rules. Emergency spill containment and cleanup contingency actions would also be included in the transportation plan to address material spills. Because not all actions would presumably be performed concurrently, it is estimated that the disposal actions described in OU-5 Alternative 3A could be completed in four construction seasons (April through November). Table B-15 Assumes four seasons for the purpose of cost estimating. Because it is considered administratively and technically simple, one year of planning, design, and permitting was estimated.

Since the repository would be located within a 15 minute drive time of the excavation area, this alternative also has the second lowest amount of trucking and heavy equipment use in total vehicle hours. For example, at an assumed weight of 24 tons per truckload and an operated vehicle time of 1 hour per load, the estimated 6,440 truckloads of soil would necessitate an expenditure of approximately 6,440 hours of vehicle run time for disposal.

Based on these estimates, OU-5 Alternative 3A has the second lowest potential for additional vehicular accidents, increased wear and tear on infrastructure (streets, bridges, and highways), produces the second least amount of air pollution (from particulate matter and oxides in vehicle exhaust), traffic closures and associated inconvenience to the general public, and uses the second least amount of fossil fuels. Because of the relatively low number of hours of equipment operation and trucking, Alternative 3A is ranked medium in short-term effectiveness. Long-term effectiveness of this alternative is high. Since contaminated soils would be excavated, removed, and appropriately disposed, potential exposure reductions to those accessing the Site would be permanent.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.16.2 Implementability

OU-5 Removal Alternative 3A rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities. The excavation and stockpile sites are also readily accessible. Hauling would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to the general public and sensitive receptors. Profiling and manifesting of the material would be done in coordination with the transporters.

9.16.3 Cost

The NPV of OU-5 Removal Alternative 3A is estimated to be $6,880,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness and permanence are high, while the short-term effectiveness is medium. Because the cost is over 75% more than Alternative 3B and provides a similar level of protection, the cost-effectiveness of Alternative 3A is medium.

9.17 OU-5 DISPOSAL ALTERNATIVE 3B – DISPOSAL OF RESIDENTIAL SOIL (FROM OU-1), AT A LOCALLY CONSTRUCTED LANDFILL

Implementation of OU-5 Alternative 3B would include:

- Construction of a soil repository within the Town of Eureka including lined channels, temporary and permanent caps, storm water controls, etc.
- Loading and hauling contaminated soil to the repository over several construction seasons.
- Temporary traffic control measure during periods of high-volume hauling.
- Grading, capping, and site restoration work on the repository area.
- Implement ICs for the repository area.

9.17.1 Effectiveness

The effectiveness of OU-5 Removal Alternative 3B is considered high for achieving the RAOs. This alternative would permanently eliminate the potential exposure to contaminated materials at the Site. Potential limited exposures during excavation, transport, crushing, stabilization, and at the final disposal sites would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative.

Applicability of each of the location-specific ARARs defined in Table 16 would need to be investigated and requirements adhered to as indicated before any work is completed. Other Federal and State ARARs would be met for the Site under this alternative. Action-specific ARARs (Table 17) for this alternative, to the extent applicable, include:

- Solid Waste (Federal) – RCRA (42 U.S.C. 42 U.S.C. §§ 6901 et seq.; 40 CFR Part 264, Subpart N; 42 U.S.C. §6921(a)(3)(A)(ii); and 40 CFR 261.4(7)
- Solid Waste (Nevada) – Solid Waste Management Systems (NAC §§ 444.6405; 444.641; 444.6415; 444.6419; 444.6426; 444.643; 444.6435; 444.644; 444.6445; 444.658)
- Hazardous Materials (Federal) – Hazardous Materials Transportation Law (CFR Parts 171, 172, 173)
- Storm water (Federal) – CWA 40 CFR § 122.26)
- Air (Nevada) – NAC §445B.22037

This alternative involves the least amount of material transfer, stockpile development/management, loading of bulk hazardous material carriers, truck traffic, fossil fuel use, and site restoration activities of any of the disposal alternatives. Bulk carriers hauling the waste from the excavation are to the repository would be covered and secured prior to transport. Truck traffic would be coordinated under a transportation plan for routes, times of operation, and on-site traffic rules. Emergency spill containment and cleanup contingency actions would also be included in the transportation plan to address material spills. Because not all actions would presumably be performed concurrently, it is estimated that the disposal actions described in OU-5 Alternative 3B could be completed in three to four construction seasons (April through November). Table B-16 Assumes three seasons for the purpose of cost estimating. Because it is considered administratively and technically simple, one year of planning, design, and permitting was estimated.

Since the repository would be located within a 15 minute drive time of the excavation area, this alternative has the lowest amount of trucking and heavy equipment use in total vehicle hours. For example, at an assumed weight of 24 tons per truckload and an operated vehicle time of 1 hour per load, the estimated 3,015 truckloads of soil would necessitate an expenditure of approximately 3,015 hours of vehicle run time for disposal.

Based on these estimates, OU-5 Alternative 3B has the lowest potential for additional vehicular accidents, increased wear and tear on infrastructure (streets, bridges, and highways), produces the least amount of air pollution (from particulate matter and oxides in vehicle exhaust), traffic closures and associated inconvenience to the general public, and uses the least amount of fossil fuels. Because of the low number of hours of equipment operation and trucking, and because it requires the smallest footprint (and associated importation of cap material) of any of the local repository options, Alternative 3B is ranked high in short-term effectiveness. Long-term effectiveness of this alternative is high. Since contaminated soils would be excavated, removed, and appropriately disposed, potential exposure reductions to those accessing the Site would be permanent.

This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site.

9.17.2 Implementability

OU-5 Removal Alternative 3B rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities. The excavation and stockpile sites are also readily accessible. Hauling would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to the general public and sensitive receptors. Profiling and manifesting of the material would be done in coordination with the transporters.

9.17.3 Cost

The NPV of OU-5 Removal Alternative 3B is estimated to be $4,320,000. The overall effectiveness was compared to the cost to determine whether the remedy is cost-effective. The long-term effectiveness, short-term effectiveness, and permanence are all considered high. Because Alternative 3B is the least expensive of any disposal option and provides a similar level of protection, the cost-effectiveness of Alternative 3B is high.

10. RECOMMENDED REMOVAL AND DISPOSAL ALTERNATIVES

Based on the comparative analyses of removal and disposal alternatives presented in Section 9, the following sections recommend the preferred alternative for each OU.

10.1 OU-1 RECOMMENDED REMOVAL ALTERNATIVE

The recommended Removal Action for OU-1 is Alternative 3 – Soil Removal and Capping at Tier I, Tier II, and Tier III properties; ICs; and Outreach and Education Programs.

Under Alternative 3, there are 92 known residential properties and 135 projected residential properties that exceed the Tier I, Tier II, and Tier III site-specific cleanup levels. There would be an estimated total volume of 60,200 CY of waste (including the existing 10,600 CY stockpile of contaminated soil) generated from the 227 total residential properties (known and projected) that would be addressed under Alternative 3. Contaminated residential soil from these properties should be removed because of their elevated lead and arsenic concentrations and the potential impacts to human health and the environment from these concentrations. Even at the Tier III site-specific cleanup levels (the lowest prioritization Tier), lead concentrations range between 425 mg/kg and 1,275 mg/kg, and arsenic concentrations range between 234 mg/kg and 326 mg/kg at residential properties.

This alternative provides significant protection to human health and the environment at OU-1 residential properties and the local area. It complies with both Federal and State ARARs at all three residential property tiers, and is considered high for achieving the RAOs at all three residential property tiers by providing control of soil concentrations, mobility, and a reduction in risk to human health and the environment at the Site.

Alternative 3 is expected to provide short-term and long-term effectiveness and is expected to be both technically and administratively feasible. In addition, site-specific ICs and outreach and education programs would be designed and implemented under this alternative to ensure the integrity of the cleanup actions.

Alternative 3 is recommended rather than Alternative 2 since it provides a protective, long-term effective remedy for Tier I, Tier II and Tier III properties; whereas, Alternative 2 does not provide a protective, long-term effective remedy for Tier III properties. Alternative 2 relies entirely on long term ICs to provide a permanent long-term remedy for Tier III properties; whereas, Alternative 3 combines both excavation and long-term ICs for Tier III properties to provide a permanent long-term remedy. Given that the draft ICs proposed by Eureka County and NDEP are voluntary rather than mandatory, a remedy that relied on ICs as the sole source of protection for Tier III properties is deemed to be less protective. Additionally, the cost difference between Alternative 2 and Alternative 3 is not considered substantial in comparison to the total cost of the OU.

10.2 OU-2 RECOMMENDED REMOVAL ALTERNATIVE

The recommended Removal Action for OU-2 is Alternative 4 – Limited Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with 2 Feet of Soil Cover; and ICs.

Alternative 4 provides the best balance between cost, effectiveness, and implementability of the OU-2 alternatives and provides a high level of protection to human health and the environment at OU-2 and the local area. It complies with both Federal and State ARARs, and is considered high for achieving OU-2 RAOs by isolating and capping hazardous substances within consolidated waste repositories, providing control of slag/soil contaminant concentrations and mobility, and providing a reduction in risk to human health and the environment at the Site. In addition, Alternative 4 minimizes the size/volume of a locally constructed repository and the amount of soil/slag that would potentially need to be disposed of elsewhere. Implementation of Alternative 4 reduces the amount of cap material and channel construction work that would need to be performed in conjunction with the entire project.

Alternative 4 is expected to provide short-term and long-term effectiveness and is expected to be both technically and administratively feasible. Site-specific ICs would be designed and implemented under this alternative to ensure the integrity of the cleanup actions.

10.3 OU-3 RECOMMENDED REMOVAL ALTERNATIVE

The recommended Removal Action for OU-3 is Alternative 3 – Smelter and Mill Footprint Area Slope Capping With 1 Foot Of Rock (Rock Slope Protection); Limited 1-Foot Soil Excavation And Removal With 1-Foot Soil Cap in Residential Areas; and ICs.

Alternative 3 provides the best balance between cost, effectiveness, and implementability of the OU-3 alternatives and provides a high level of protection to human health and the environment at OU-3 and the local area. It complies with both Federal and State ARARs, and is considered high for achieving OU-3 RAOs by isolating and capping hazardous substances, providing control of soil contaminant concentrations and mobility, and providing a reduction in risk to human health and the environment at the Site. In addition, in comparison to OU-3 Alternative 2, Alternative 3 significantly minimizes the size/volume of a locally constructed repository or the amount of soil that would potentially need to be hauled disposed of elsewhere thereby using less fossil fuels and creating less by-product pollution.

Alternative 3 is expected to provide short-term and long-term effectiveness and is expected to be both technically and administratively feasible. Site-specific ICs would be designed and implemented under this alternative to ensure the integrity of the cleanup actions.

10.4 OU-4 RECOMMENDED REMOVAL ALTERNATIVE

The recommended Removal Action for OU-4 is Alternative 1 – No Action.

Although Alternative 1 does not provide immediate protection to human or environmental exposure, historical data collected from the Site have not completely defined the full impacts of lead and arsenic contamination at OU-4 and or other areas within the Town of Eureka. Minimal amounts of sampling data have been previously collected at OU-4, and in order to fully identify and define the extent of impacts of lead and arsenic contamination to OU-4, a long-term sampling monitoring program of surface water should be considered prior to performing removal or remedial actions. Additionally, if the other actions at OU-1, OU-2, and OU-3 are performed, concentrations of lead and arsenic in Eureka Creek would be expected to decline slowly over time. This is especially true if removal actions are performed at the OU-2 Slag Piles, which are immediately adjacent to OU-4 at both upstream and downstream locations, and are expected to be the primary source of contamination impacting OU-4.

Although a human health risk assessment has not been performed at OU-4, based on observations by the OSCs and conversations with Eureka County officials, it is believed that public access to and use of Eureka Creek is limited. Water from Eureka Creek is used to supply a livestock pond, but EPA has not been granted access to sample this pond. Because of the limited risk and the limited data documenting risk associated with exposure to water and sediment within Eureka Creek, EPA is recommending the No Action alternative.

10.5 OU-5 RECOMMENDED DISPOSAL ALTERNATIVE

The recommended Disposal Action for OU-5 is Alternative 3B – Disposal of Residential Soil at a Locally Constructed Landfill.

Alternative 3B provides the best balance between cost, effectiveness, and implementability of the OU-5 Alternatives and provides a high level of protection to human health and the environment, and the local area. It complies with both Federal and State ARARs, and is considered high for achieving OU-5 RAOs by isolating and capping hazardous substances within a consolidated waste landfill, and providing control of soil contaminant concentrations and mobility, and providing a reduction in risk to human health and the environment at the Site. In addition, Alternative 3B is the smallest size/volume of the locally constructed landfills alternatives, which in turn impacts the least land and has the least associated costs.

Alternative 3B is expected to provide short-term and long-term effectiveness and is expected to be both technically and administratively feasible. Site-specific ICs would be designed and implemented under this alternative to ensure the integrity of the cleanup actions.

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APPENDIX A
FIGURES

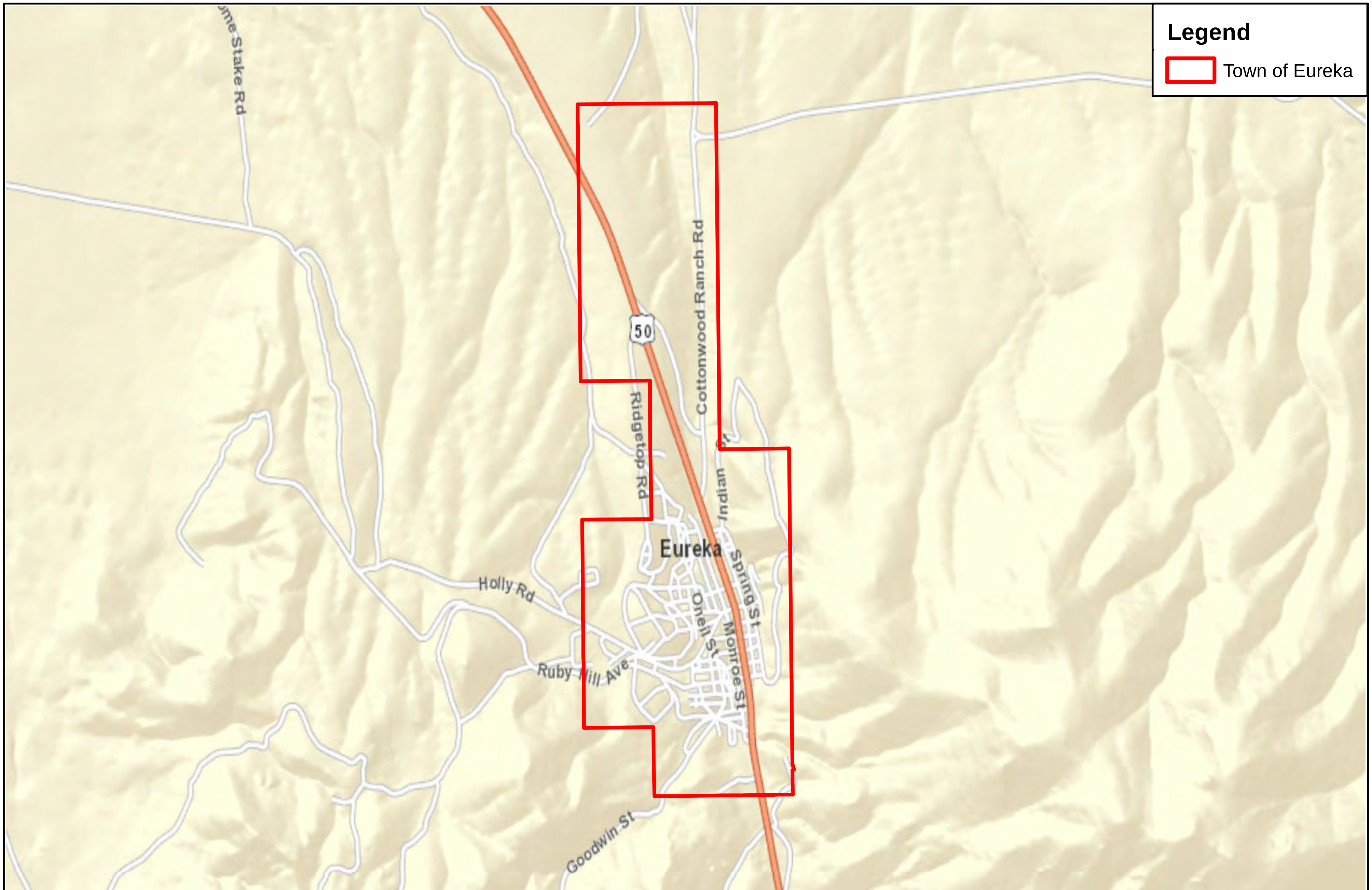

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FIGURE 1
REGIONAL SITE LOCATION MAP
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada

Contract: EP-S5-13-02; **TDD:** 1302-T2-R9-14-10-0002

Project Number: 20409.012.002.0022.00

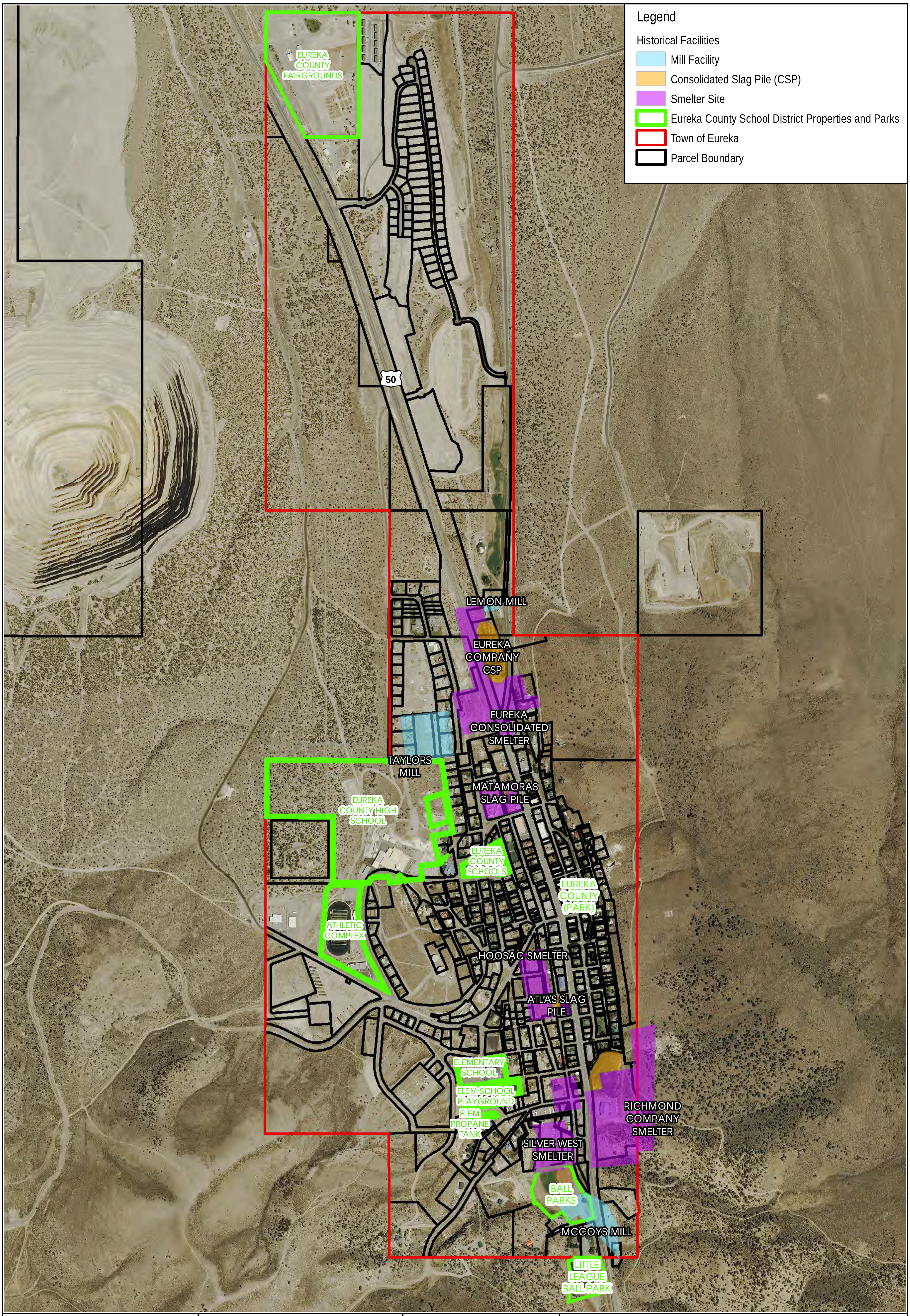

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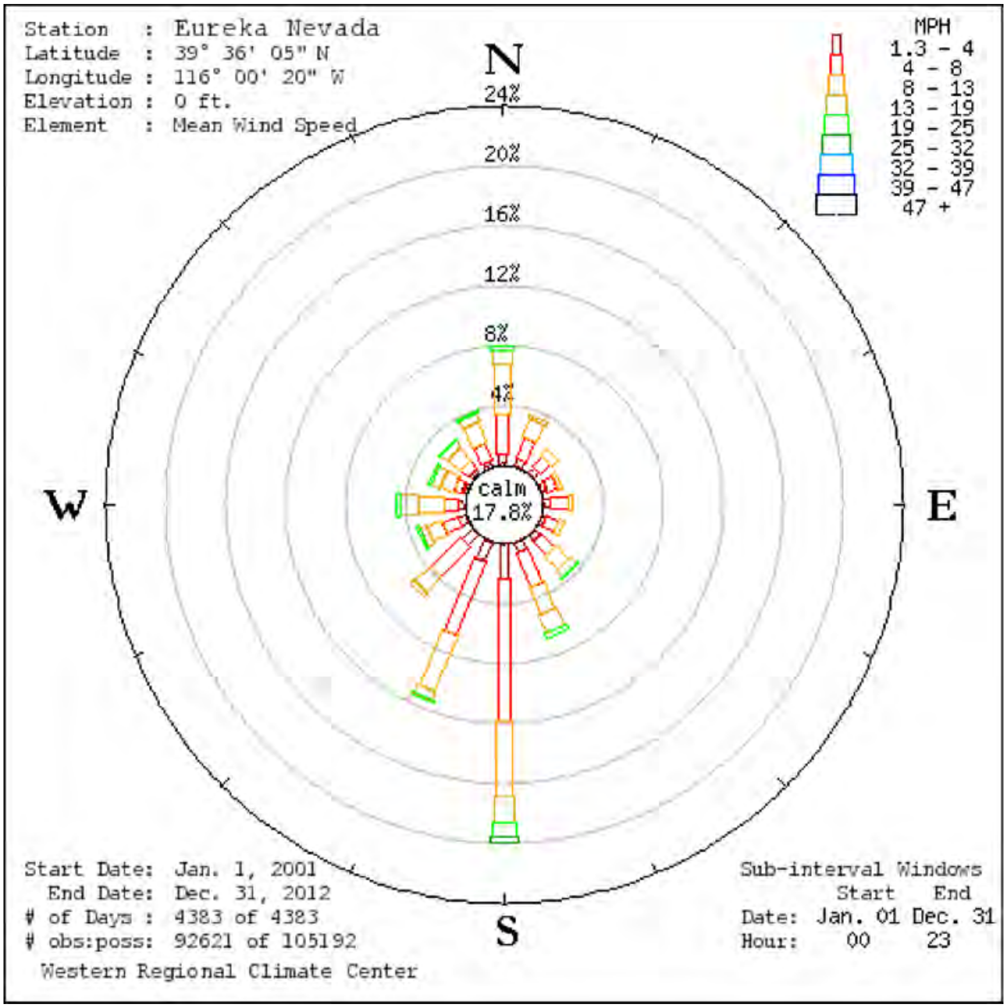
FIGURE 2
SITE LOCATION MAP
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada

Contract: EP-S5-13-02; **TDD:** 1302-T2-R9-14-10-0002

Project Number: 20409.012.002.0022.00



Eureka Nevada - Wind Frequency Table (percentage)

Latitude : 39° 36' 05" N
Longitude : 116° 00' 20" W
Elevation : 0 ft.
Element : Mean Wind Speed

Start Date : Jan. 1, 2001
End Date : Dec. 31, 2012
# of Days : 4383 of 4383
obs : poss : 92621 of 105192

Sub Interval Windows
Start End
Date Jan. 01 Dec. 31
Hour 00 23

(Greater than or equal to initial interval value and Less than ending interval value.)

Range (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
1.3 - 4	0.6	0.4	0.4	0.3	0.5	0.3	0.5	0.7	2.3	1.3	0.9	0.5	0.3	0.2	0.2	0.2	9.8
4 - 8	2.7	1.5	1.0	0.7	1.1	0.8	1.3	2.4	9.4	5.3	2.9	1.1	0.9	0.5	0.7	1.2	33.4
8 - 13	3.4	1.3	0.5	0.2	0.3	0.4	1.2	1.9	5.1	4.0	1.4	1.1	1.8	0.9	1.1	1.5	26.3
13 - 19	1.0	0.3	0.0	0.0	0.0	0.1	0.5	1.3	1.7	0.6	0.2	0.4	1.1	0.6	0.5	0.5	9.0
19 - 25	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.0	0.2	0.1	0.1	0.3	0.2	0.1	0.1	2.8
25 - 32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.7
32 - 39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
39 - 47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47 -	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total(%)	7.8	3.5	2.0	1.3	2.0	1.7	3.6	6.8	20.0	11.5	5.4	3.2	4.6	2.4	2.7	3.7	82.2
Calm (<1.3)																	17.8
Ave Speed	9.0	7.8	6.4	5.9	5.7	6.8	8.8	9.7	8.6	7.6	6.9	8.9	11.4	11.1	10.1	9.4	7.0

N
0 Scale in Feet 100

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FIGURE 3
WIND ROSE, EUREKA AIRPORT
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada

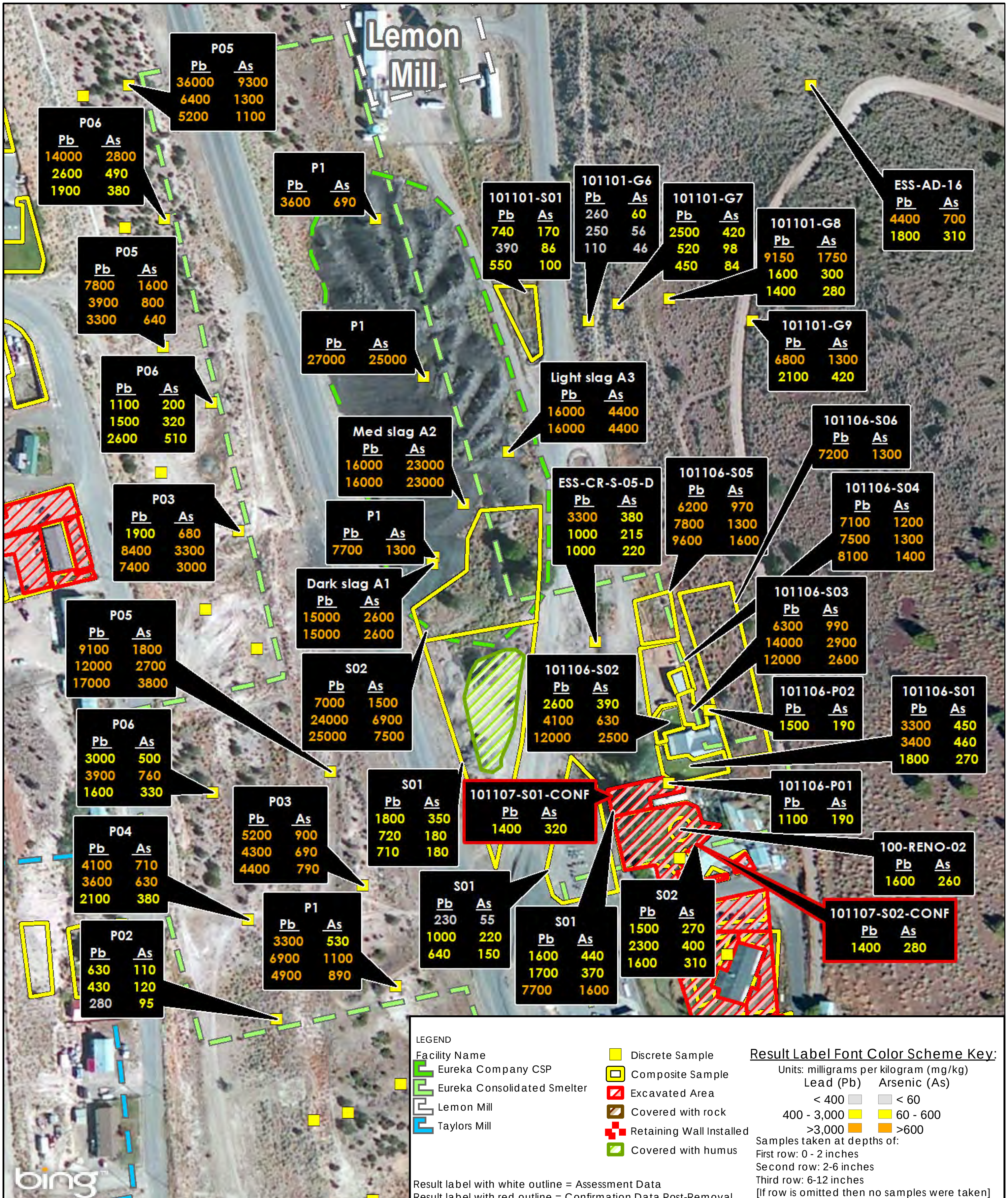

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FIGURE 4

Eureka Consolidated Smelter and Lemon Mill
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada

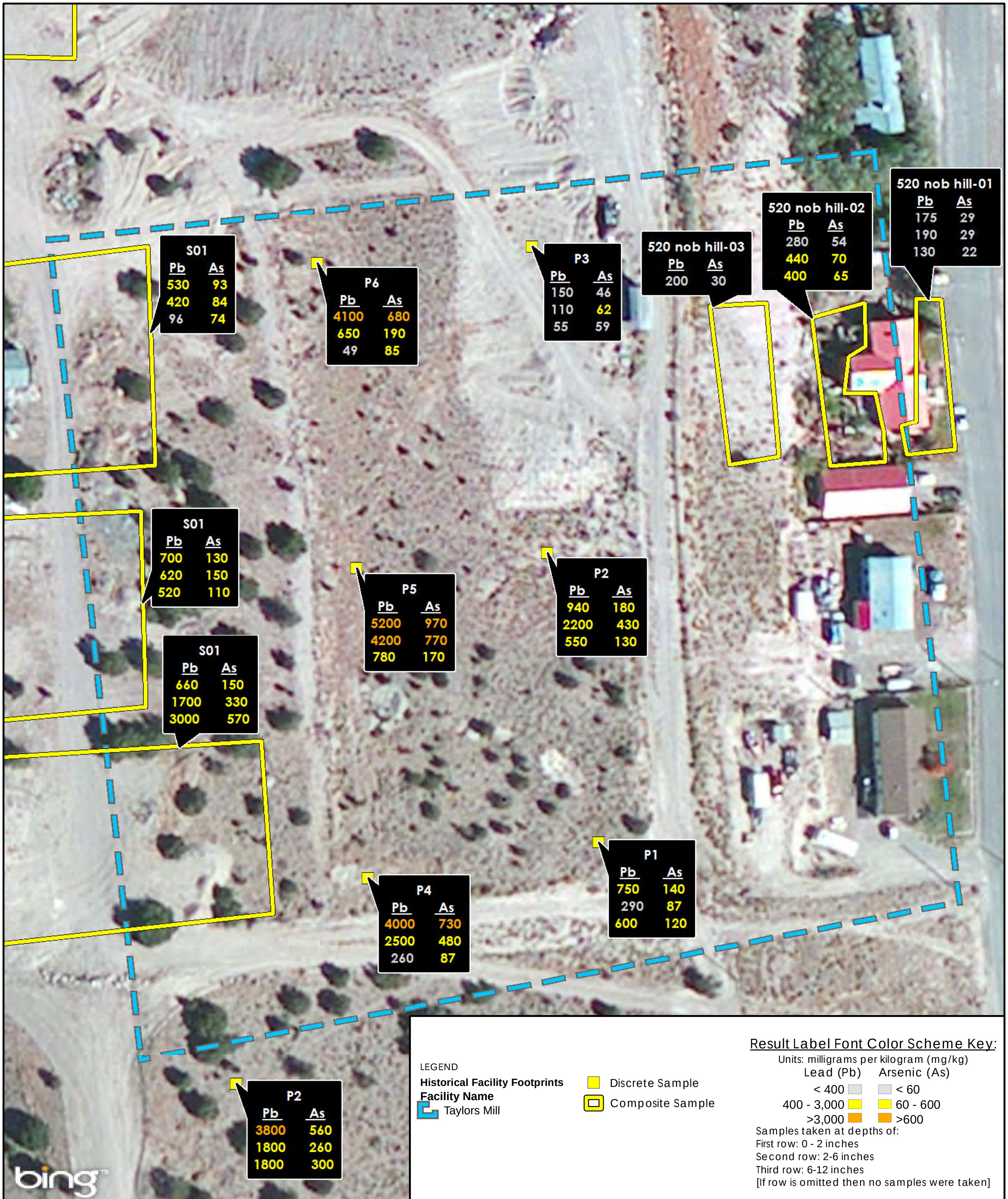

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FIGURE 5
Taylors Mill
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada

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Project Number: 20409.012.002.0022.00

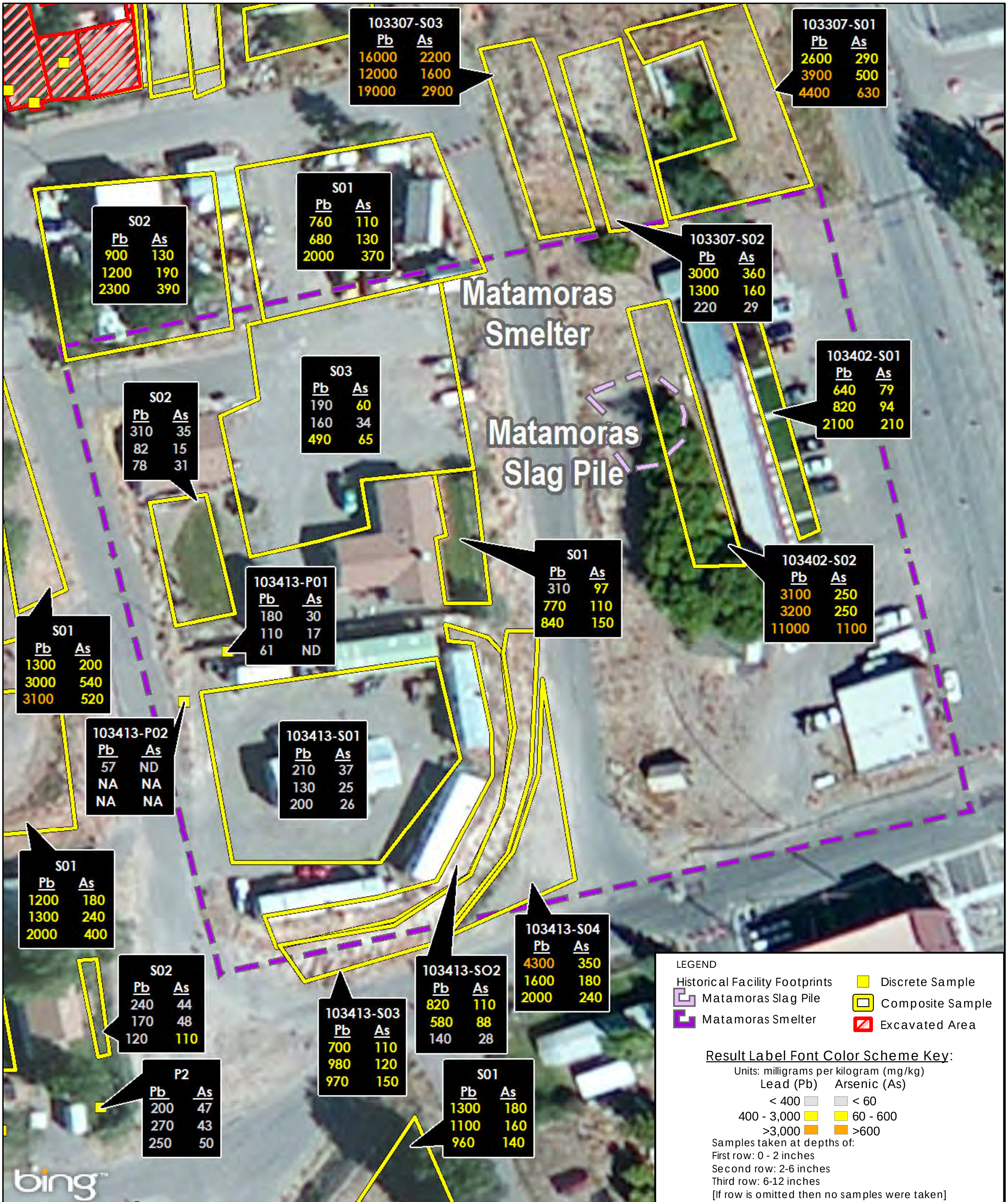

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FIGURE 6
MATAMORAS SMELTER AND SLAG PILE
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada

Contract: EP-S5-13-02; **TDD:** 1302-T2-R9-14-10-0002 **Project Number:** 20409.012.002.0022.00

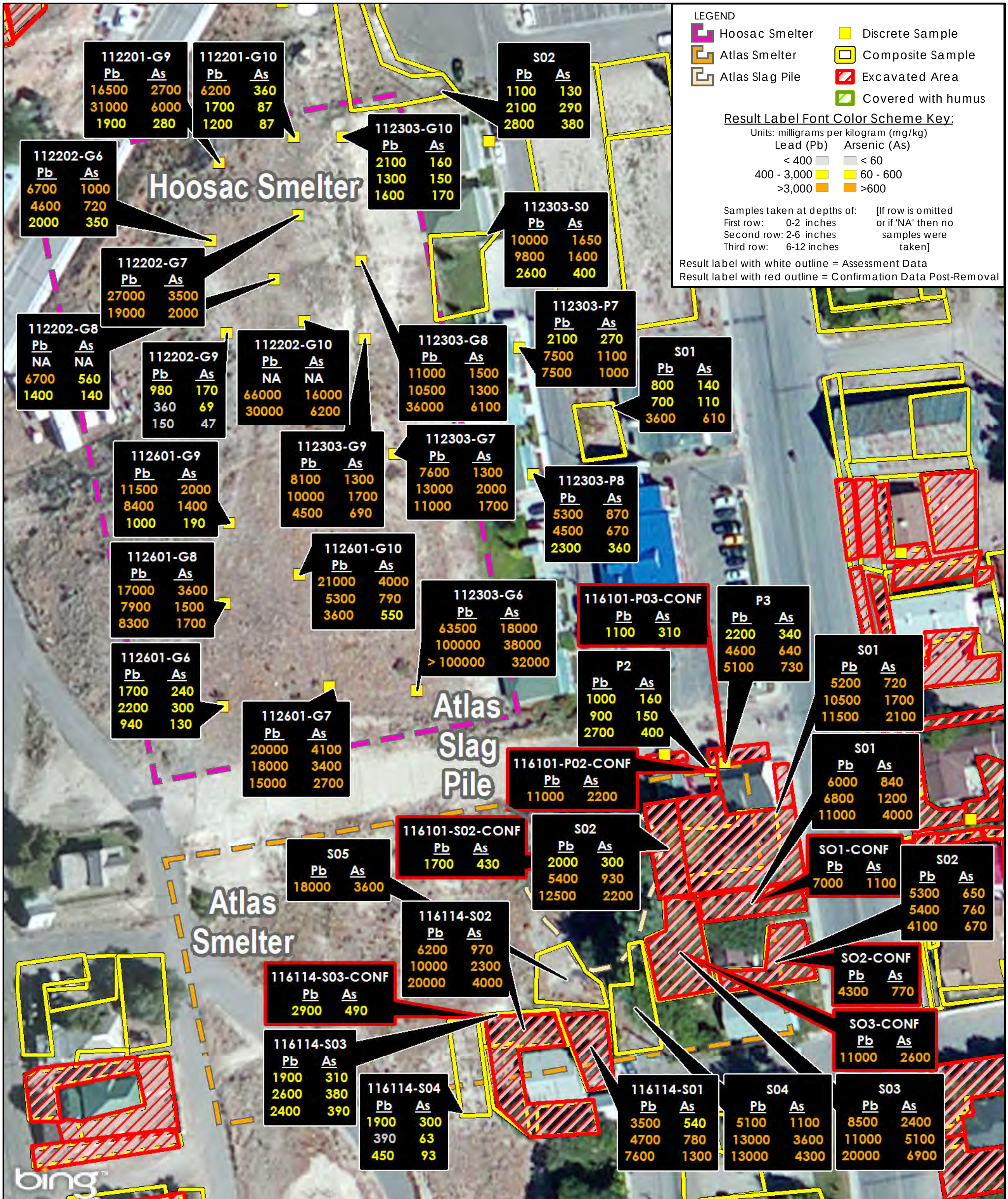

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FIGURE 7
Hoosac Smelter and Atlas Smelter
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada

Contract: EP-S5-13-02; **TDD:** 1302-T2-R9-14-10-0002 **Project Number:** 20409.012.002.0022.00

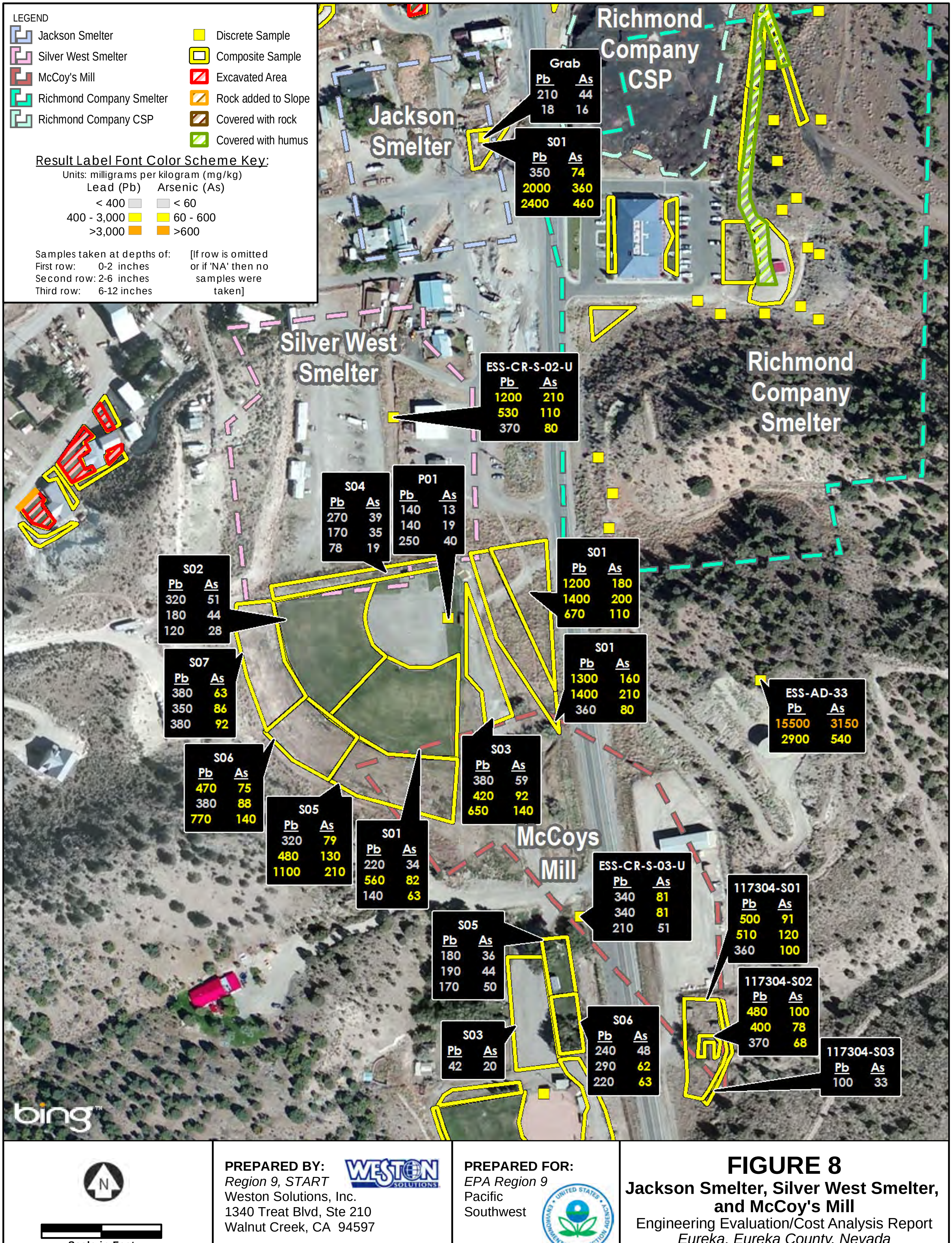

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FIGURE 8
Jackson Smelter, Silver West Smelter, and McCoy's Mill
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada

Contract: EP-S5-13-02; **TDD:** 1302-T2-R9-14-10-0002

Project Number: 20409.012.002.0022.00

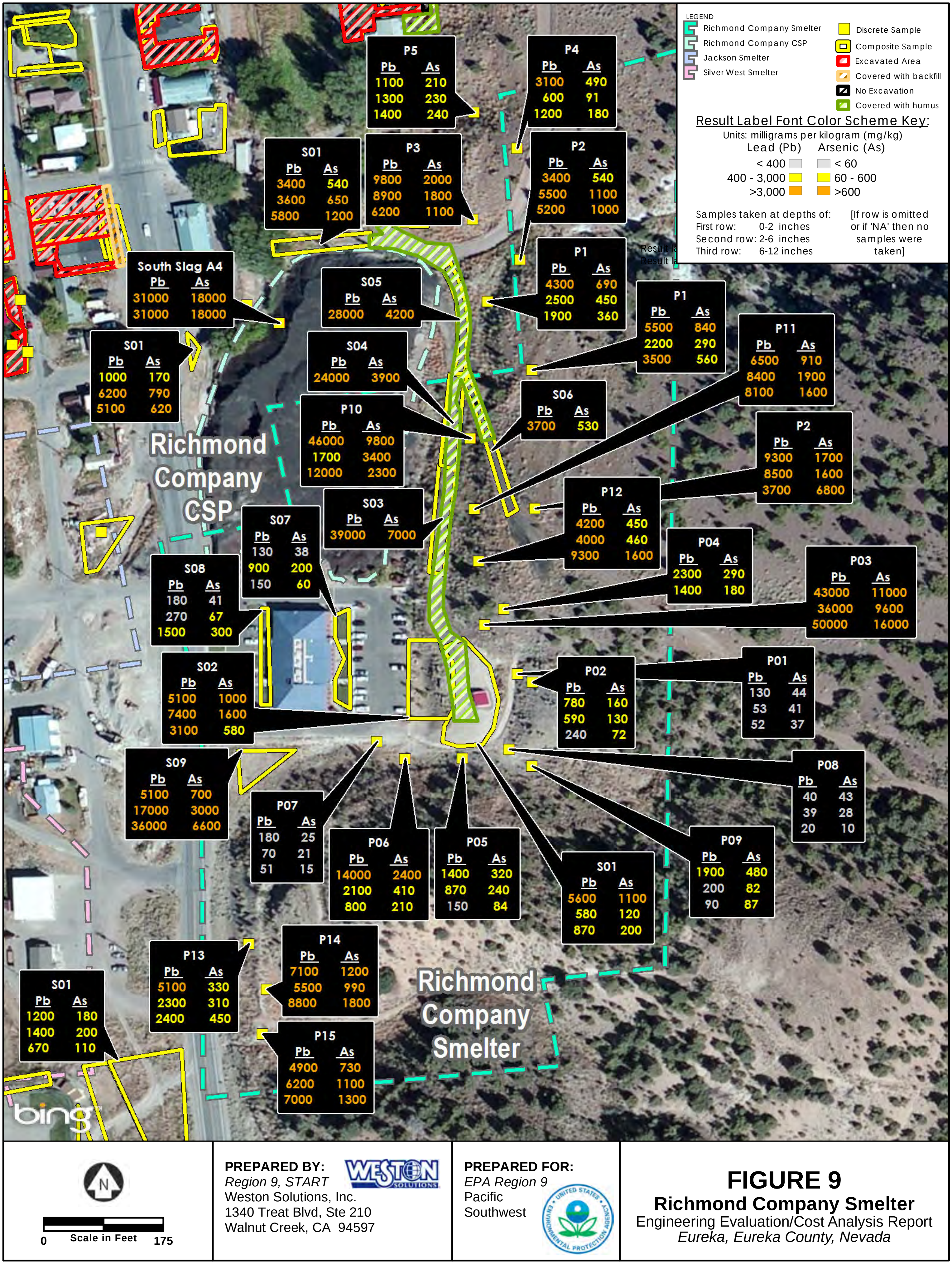

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FIGURE 9
Richmond Company Smelter
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada

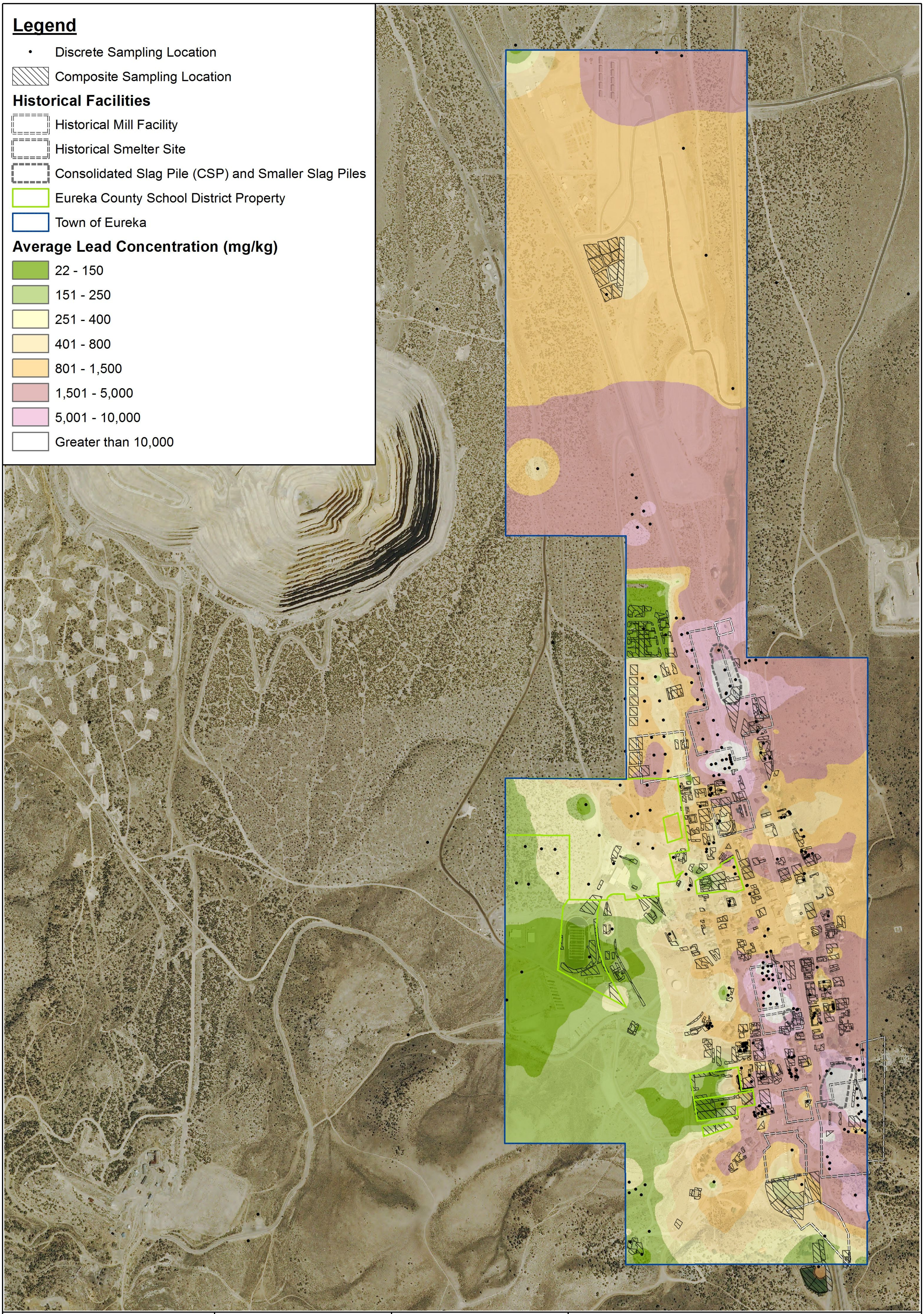

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FIGURE 10
Isoconcentration Map for Lead
Engineering Evaluation / Cost Analysis Report
Eureka, Eureka County, Nevada

Contract: EP-S5-13-02; TDD: 1302-T2-R9-14-10-0003

Project Number: 20409.012.002.0022

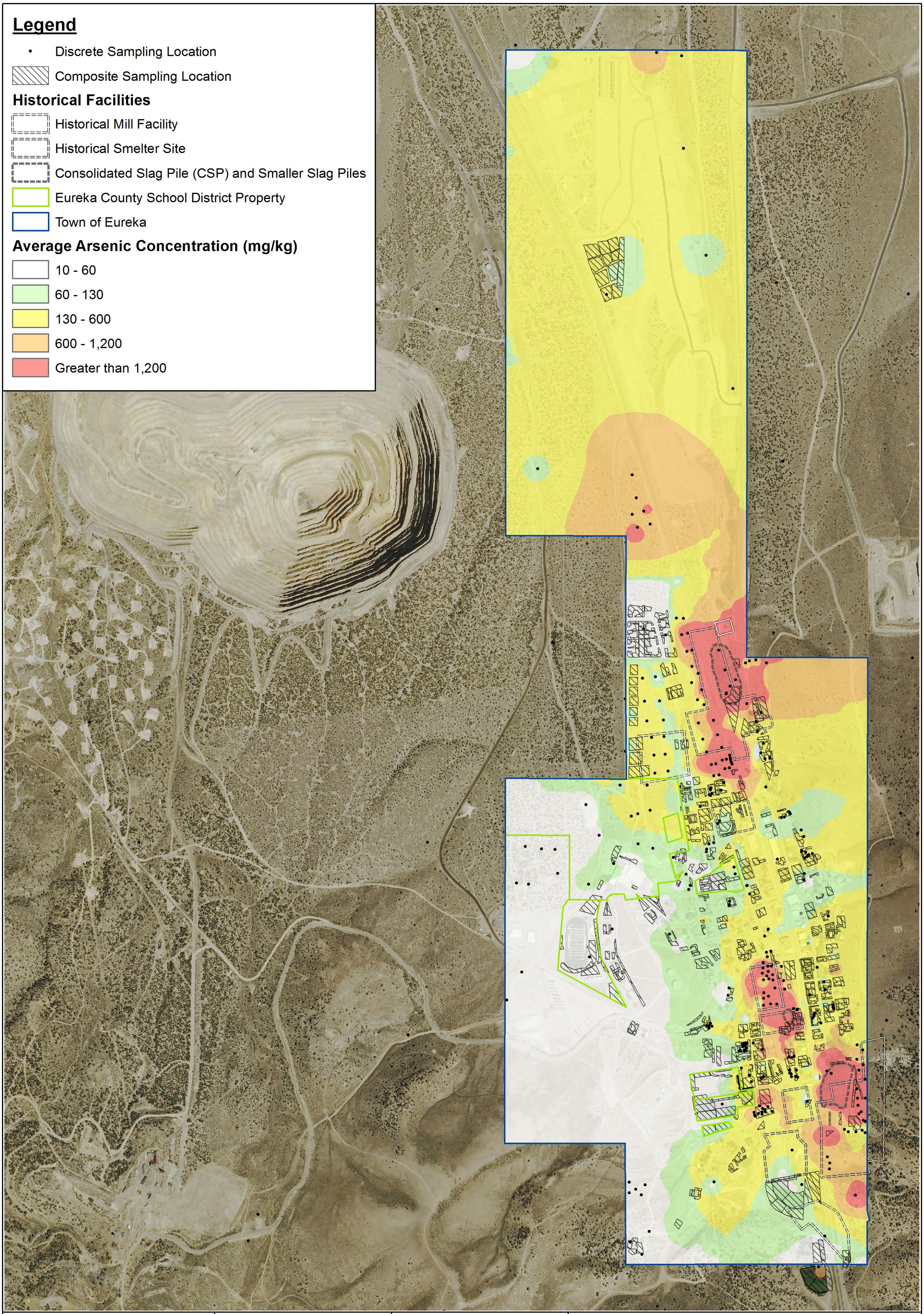

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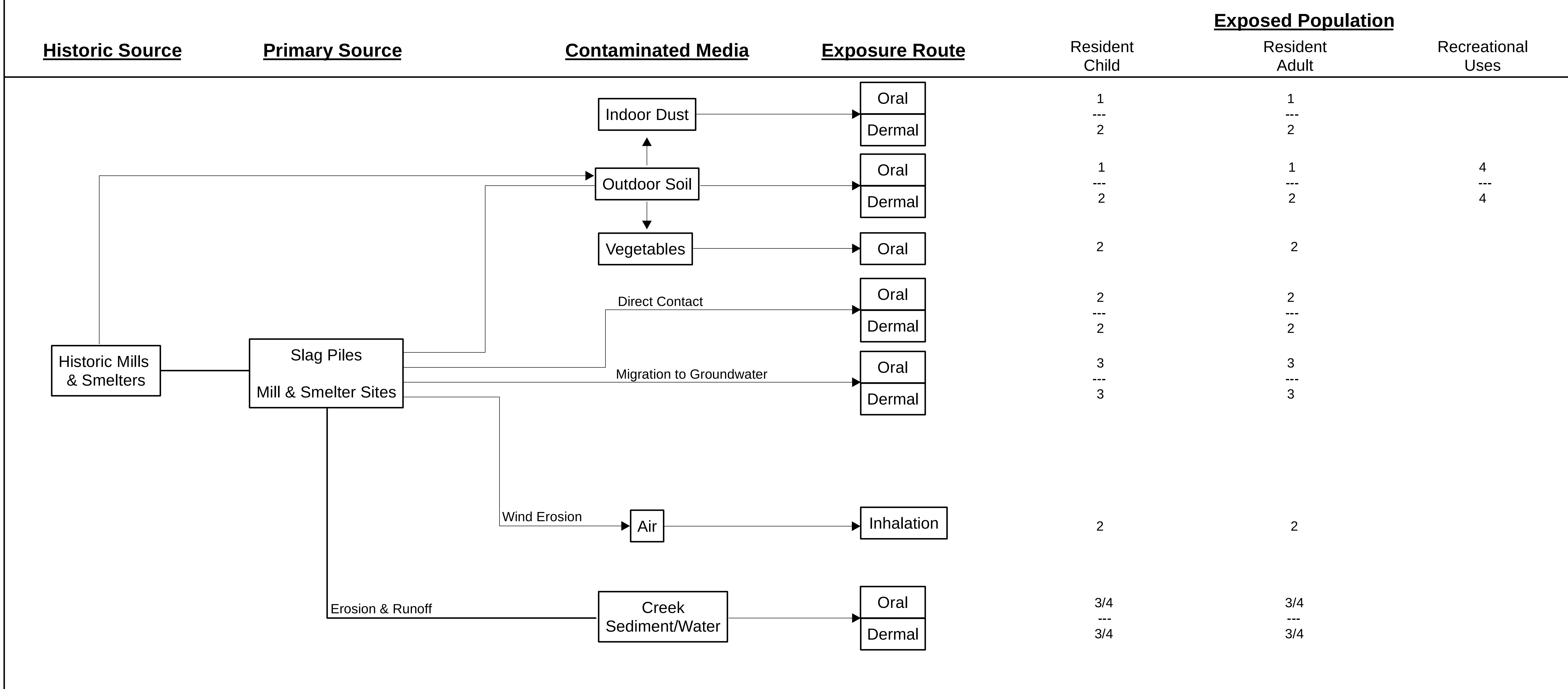
FIGURE 11
Isoconcentration Map for Arsenic
Engineering Evaluation / Cost Analysis Report
Eureka, Eureka County, Nevada



1. Pathway is or may be complete - May be significant risk
2. Pathway is or may be complete - Less significant risk
3. Pathway not likely complete
4. Insufficient data or outside scope of EE/CA

0 Scale in Feet 300

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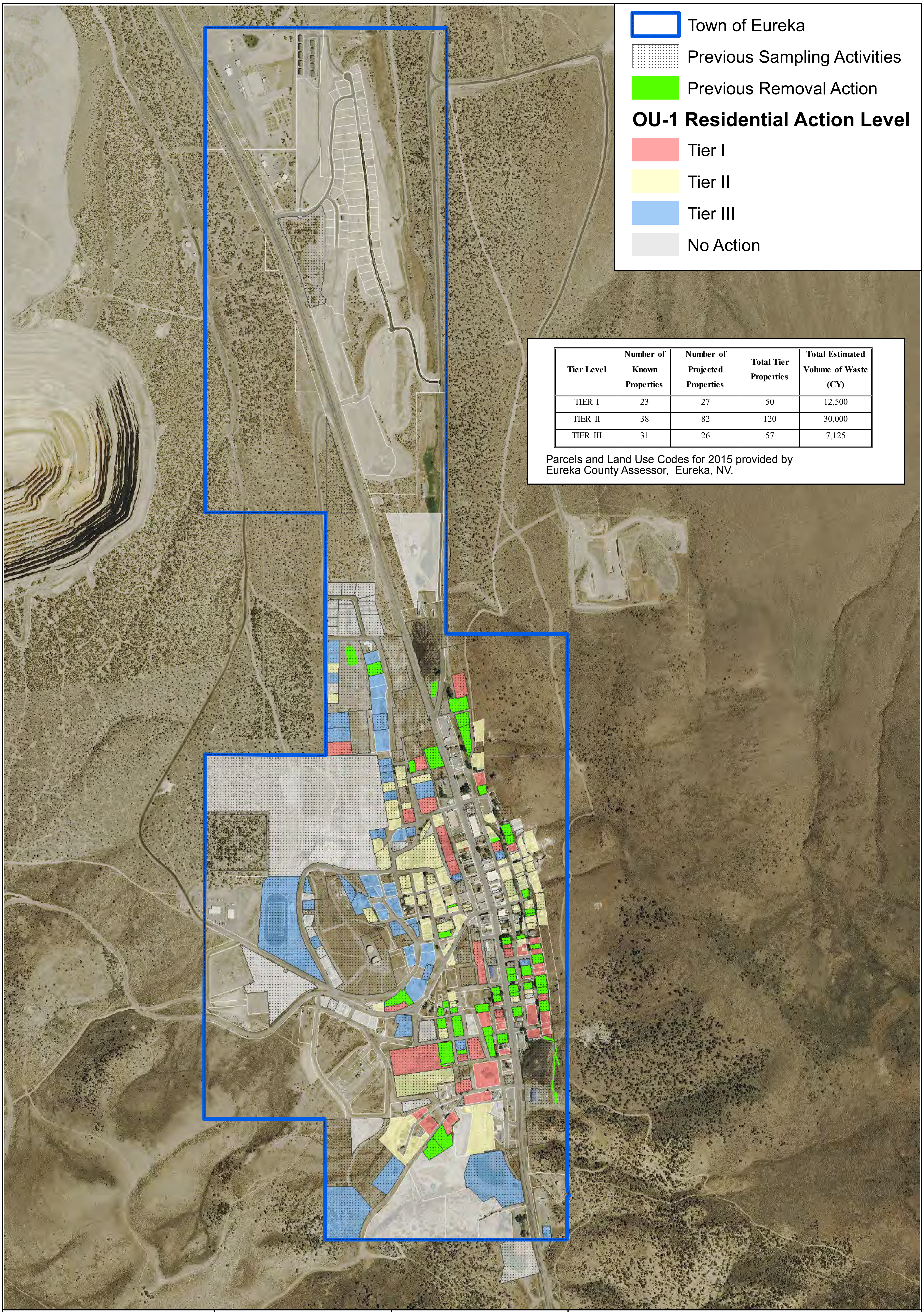
FIGURE 12
CONCEPTUAL SITE MODEL
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada



Tier Level	Number of Known Properties	Number of Projected Properties	Total Tier Properties	Total Estimated Volume of Waste (CY)
TIER I	23	27	50	12,500
TIER II	38	82	120	30,000
TIER III	31	26	57	7,125

Parcels and Land Use Codes for 2015 provided by Eureka County Assessor, Eureka, NV.

0 Scale in Feet 2,000

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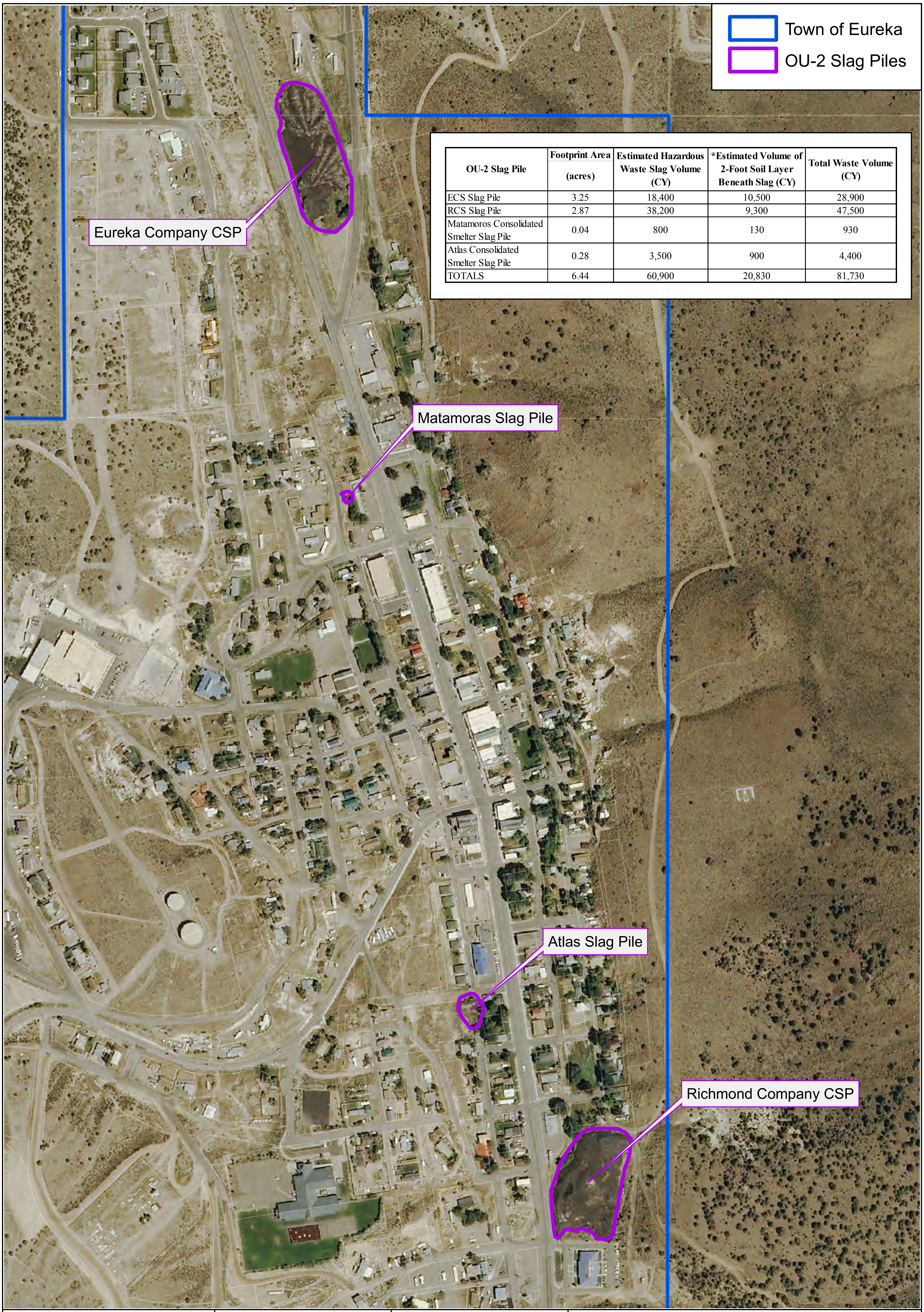
FIGURE 13
OU-1 RESIDENTIAL PROPERTIES
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada



OU-2 Slag Pile	Footprint Area (acres)	Estimated Hazardous Waste Slag Volume (CY)	*Estimated Volume of 2-Foot Soil Layer Beneath Slag (CY)	Total Waste Volume (CY)
ECS Slag Pile	3.25	18,400	10,500	28,900
RCS Slag Pile	2.87	38,200	9,300	47,500
Matamoros Consolidated Smelter Slag Pile	0.04	800	130	930
Atlas Consolidated Smelter Slag Pile	0.28	3,500	900	4,400
TOTALS	6.44	60,900	20,830	81,730

N

0 Scale in Feet 1,000

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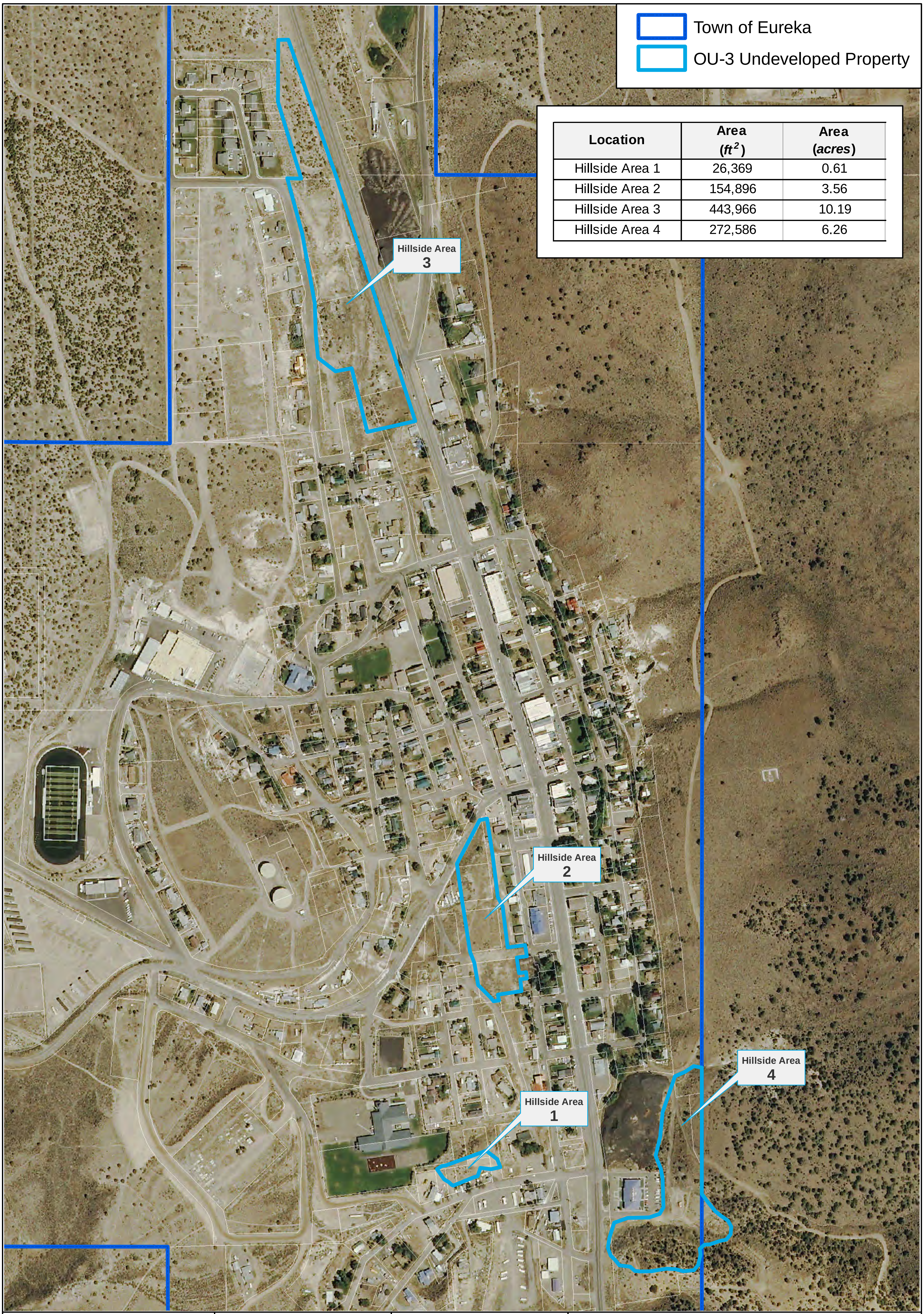
FIGURE 14
OU-2 SLAG PILES
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada



Location	Area (ft^2)	Area (*acres*)
Hillside Area 1	26,369	0.61
Hillside Area 2	154,896	3.56
Hillside Area 3	443,966	10.19
Hillside Area 4	272,586	6.26

0 Scale in Feet 1,000

PREPARED BY:
Region 9, START
Weston Solutions, Inc.
1340 Treat Blvd, Ste 210
Walnut Creek, CA 94597

PREPARED FOR:
EPA Region 9
Emergency
Response
Section

FIGURE 15

OU-3 UNDEVELOPED PARCELS WITHIN OR ADJACENT TO SMELTER AND MILL SITES

Engineering Evaluation/Cost Analysis Report

Eureka, Eureka County, Nevada

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Region 9, START
Weston Solutions, Inc.
1340 Treat Blvd, Ste 210
Walnut Creek, CA 94597

PREPARED FOR:
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Response
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FIGURE 16

OU-4 EUREKA CREEK

Engineering Evaluation/Cost Analysis Report

Eureka, Eureka County, Nevada

Contract: EP-S5-13-02; **TDD:** 02-1410002

Project Number: 20409.012.002.0022

APPENDIX B
COST SUMMARY TABLES AND PRELIMINARY CONSTRUCTION ESTIMATES

Table B-1A SUMMARY OF ALTERNATIVE COSTS
Town of Eureka, Eureka County, Nevada

OPERABLE UNIT (OU)	ALTERNATIVE (Alt)	ALTERNATIVE DESCRIPTION	ALTERNATIVE CAPITAL COST	ANNUAL OPERATION AND MAINTANANCE (O&M) COST	ALTERNATIVE TOTAL PRESENT WORTH - NO DISPOSAL	ESTIMATED DISPOSAL VOLUME (CY)	EXISTING OFF-SITE LANDFILL DISPOSAL COST[1]	ALTERNATIVE TOTAL PRESENT WORTH WITH EXISTING LANDFILL DISPOSAL	LOCALLY CONSTRUCTED LANDFILL DISPOSAL COST	ALTERNATIVE TOTAL PRESENT WORTH WITH LOCAL LANDFILL DISPOSAL	PLANNING YEARS	YEARS TO CONSTRUCT
OU-1 RESIDENTIAL PROPERTIES												
OU-1	Alt 1	No Further Action	--	--	--	--	--	--	--	--	-	0 years
OU-1	Alt 2	Soil Removal and Capping at Tier I and Tier II Properties; ICs; and Outreach and Education Programs	$ 16,650,000	$ -	$ 16,650,000	53,100	$ 8,186,000	$ 24,836,000	$ 3,823,000	$ 20,473,000	1 year	3-4 years
OU-1	Alt 3	Soil Removal and Capping at Tier I, Tier II, and Tier III Properties; ICs; and Outreach and Education Programs	$ 17,910,000	$ -	$ 17,910,000	60,225	$ 9,285,000	$ 27,195,000	$ 4,336,000	$ 20,986,000	2 years	3-4 years
OU-2 SLAG PILES												
OU-2	Alt 1	No Action	--	--	--	--	--	--	--	--	6 months	--
OU-2	Alt 2	Removal of Slag Piles to an Existing Off-Site Landfill; and ICs	$ 3,233,000	$ -	$ 3,233,000	60,900	$ 19,198,000	$ 22,431,000	--	--	2-4 years	6 Months
OU-2	Alt 3	Consolidation, Grading, and In-Place Capping of Slag Piles with a 2 Foot Soil Cover; and ICs	$ 2,581,000	$ 68,000	$ 3,551,000	--	--	--	--	--	2-4 years	6 Months
OU-2	Alt 4	Limited Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with a 2 Foot Soil Cover; and ICs	$ 2,674,000	$ 68,000	$ 3,644,000	--	--	--	--	--	2-4 years	7 Months
OU-2	Alt 5	Maximized Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with a 2-Foot Soil Cover; and ICs	$ 4,393,000	$ 68,000	$ 5,449,000	--	--	--	--	--	2-4 years	2 years
OU-3 UNDEVELOPED PARCELS WITHIN OR ADJACENT TO FORMER SMELTER AND MILL SITES												
OU-3	Alt 1	No Further Action	--	--	--	--	--	--	--	--	--	--
OU-3	Alt 2	Smelter and Mill Footprint Area 1 Foot Soil Excavation and Removal with 1 Foot Soil and/or Rock Cover on >10% Slopes; and ICs	$ 4,396,000	$ 17,000	$ 4,639,000	33,250	$ 5,126,000	$ 9,765,000	$ 1,995,000	$ 6,634,000	2 years	2 years
OU-3	Alt 3	Smelter and Mill Footprint Area Slope Capping with 1-Foot of Rock (Rock Slope Protection); Limited 1 Foot Soil Excavation and Removal with 1 Foot Soil Cap in Residential Areas; and ICs	$ 3,610,000	$ 17,000	$ 3,853,000	5,650	$ 871,000	$ 4,724,000	$ 339,000	$ 4,192,000	2 years	1 year
OU-4 EUREKA CREEK												
OU-4	OU4 Alt 1	No Further Action	$ -	--	--	--	--	--	--	--	--	--
OU-4	OU4 Alt 2	Limited Excavation and Removal of 1.5 Feet Soil/Sediments; and Rip Rap Armoring	$ 2,910,000	$ 23,000	$ 3,238,000	12,028	$ 1,854,000	$ 5,092,000	$ 721,700	$ 3,959,700	2 years	1 year
OU-4	OU4 Alt 3	Excavation and Removal of 2.5 Feet of Soil/Sediments; In-Place Capping with 1 Foot of Clean Fill; and Rip Rap Armoring	$ 3,482,000	$ 23,000	$ 3,810,000	21,050	$ 3,245,000	$ 7,055,000	$ 1,262,975	$ 5,072,975	2 years	1 year
OU-5 CONTAMINATED MATERIAL DISPOSAL												
OU-5	Alt 1	Offsite Disposal of Removal Waste at an Existing Landfill	$ 37,188,000	$ -	$ 37,188,000	196,204	$ 37,188,000	--	--	--	3 months	6 months-3 years
OU-5	Alt 2	Disposal of Soil at a Locally Constructed Landfill, and Offsite Disposal of Slag Piles at an Existing Landfill Facility	$ 26,295,000	$ 68,000	$ 27,265,000	196,204	$ 15,991,700				1 year	3-4 years
OU-5	Alt 3A	Disposal of Maximum Estimated Soil from OU-1, OU-3, and OU-4 at a Locally Constructed Landfill	$ 5,905,000	$ 68,000	$ 6,875,000	137,500	--	--	--	--	1 year	4 years
OU-5	Alt 3B	Disposal of Residential Soil at a Locally Constructed Landfill	$ 3,351,000	$ 68,000	$ 4,321,000	62,300	--	--	--	--	1 year	3 years

Notes:

1. See OU-5 Cost spreadsheets for estimated per cubic yard disposal costs. OU-5 alternatives are for disposal only, or construction of a repository and associated disposal.
2. Capital costs for Slag Pile Repository and the Locally Constructed Repository increase by an estimated $220K if a 60-mil HDPE Liner is installed over the waste.
3. Disposal costs for OU-1, OU-3, or OU-4 soil removal actions decrease by an estimated $1.15M if disposal occurs in a locally constructed landfill, and decreases by $4.71M if an existing landfill is selected.
5. This alternative includes only disposal of a limited volume of contaminated soil and does not include costs for slag disposal. Average Unit cost for Soil Disposal using this alternative is $97 per cubic yard.
6. Cost for Slag hauling and disposal estimated at $10.614M

99 Year Return Period
7 Percent Discount Rate

Table B-1B SUMMARY OF DISPOSAL COSTS

Town of Eureka, Eureka County, Nevada

OPERABLE UNIT (OU)	ALTERNATIVE (Alt)	ALTERNATIVE DESCRIPTION	ALTERNATIVE CAPITAL COST	ANNUAL OPERATION AND MAINTANANCE (O&M) COST	ALTERNATIVE TOTAL PRESENT WORTH - NO DISPOSAL	ESTIMATED DISPOSAL VOLUME (CY)	EXISTING OFF-SITE LANDFILL DISPOSAL COST[1]	ALTERNATIVE TOTAL PRESENT WORTH WITH EXISTING LANDFILL DISPOSAL	LOCALLY CONSTRUCTED LANDFILL DISPOSAL COST	PLANNING YEARS	YEARS TO CONSTRUCT
OU-5 CONTAMINATED MATERIAL DISPOSAL											
OU-5	Alt 1	Offsite Disposal of Removal Waste at an Existing Landfill	$ 37,188,000	$ -	$ 37,188,000	198,400	$ 30,587,000	--		3 months	6 months-3 years
OU-5	Alt 2[2]	Disposal of Soil at a Locally Constructed Landfill, and Offsite Disposal of Slag Piles at an Existing Landfill Facility	$ 26,295,000	$ 68,000	$ 27,265,000	198,400	$ 14,890,000	--		1 year	1-4 years
OU-5	Alt 3A	Disposal of Maximum Estimated Soil from OU-1, OU-3, and OU-4 at a Locally Constructed Landfill	$ 5,905,000	$ 68,000	$ 6,875,000	137,500				1 year	4 years
OU-5	Alt 3B	Disposal of Residential Soil at a Locally Constructed Landfill	$ 3,351,000	$ 68,000	$ 4,321,000	62,300				1 year	3 years

Notes:

1. This alternative includes only disposal of a limited volume of contaminated soil and does not include costs for slag disposal. Average Unit cost for Soil Disposal using this alternative is $97 per cubic yard.
2. Cost for Slag hauling and disposal estimated at $14.89M

Table B-3 OU-1 REMOVAL ALTERNATIVE 3 - PRELIMINARY CONSTRUCTION COST ESTIMATE

Soil Removal and Capping at Tier I, Tier II, and Tier III Properties; ICs; and Outreach and Education Programs

No.	Assumptions
1	General residential soil removal excavation volumes are estimated as an average of 500 CY/per week or 2,000 CY/per month. These quantities are based on removal volumes generated by EPA during the 2013 and 2014 removal actions in Eureka, Nevada. Based on this data, the estimated total remaining residential Tier I, II, and III removal volume of 49,625 CY and the associated barrier hardening are estimated to require 24 working months over a 4 year period for completion. Because it appears unlikely that, except in very limited circumstances, soil would be able to be loaded directly into trucks, it was assumed that 90 percent of the total volume would be stockpiled prior to disposal. Disposal costs are not included in this estimate.
2	Costs include hauling the soil to the location of the current 10,600 CY stockpile.
3	The estimated amount of soil excavated from each Tier I and Tier II property is 250 CY, and the estimated amount of soil excavated from each Tier III property is 125 CY, and are based on the average soil volumes removed from 43 properties in Eureka, NV during 2013 and 2014.
4	Residential removal actions are assumed to be final actions and therefore, other than institutional controls, costs for operation and maintenance are not included in this estimate.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Soil Removal and Capping at Tier I and Tier II Properties					
C1a	General Estimated Cost Per Property	170	per Property	$ 77,000	$ 13,090,000
	Subtotal				*$ 13,090,000*
Limited Soil Removal and Capping and/or Barrier Hardening at Tier III Properties					
C2a	General Estimated Cost Per Property	57	per Property	$ 25,000	$ 1,425,000
	Subtotal				*$ 1,425,000*
Interior Residence Cleaning					
C3a	General Estimated Cost Per Residence	210	per Residence	$ 2,000	$ 420,000
	Subtotal				*$ 420,000*
Total Direct Capital Costs (Rounded to Nearest $1,000)					**$ 14,935,000**
Indirect Capital Costs					
	Permitting/Planning/Institutional Controls /Cultural Resc. Mgmt.	1%			$ 149,350
	Professional/Tech. - Project Management	3%			$ 448,050
	Professional/Tech. - GIS, Analytical, Air Monitoring	4%			$ 597,400
	Professional/Tech. - Construction Mgmt	1%			$ 149,350
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 1,344,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 16,279,000*
	Contingency Allowance	10%			$ 1,627,900
Total Capital Cost (Rounded to Nearest $1,000)					**$ 17,907,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection		per year	$ 12,000	$ -
O1b	Fence Maintenance		per year	$ 1,200	$ -
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ -*

Table B-3 **OU-1 REMOVAL ALTERNATIVE 3 - PRELIMINARY CONSTRUCTION COST ESTIMATE**

Soil Removal and Capping at Tier I, Tier II, and Tier III Properties; ICs; and Outreach and Education Programs

Annual Indirect O&M Costs					
	Administration	5%		$	-
	Insurance, Taxes, Licenses	3%		$	-
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)				*$*	-
Total Annual O&M Costs					
	Subtotal Annual O&M Costs			*$*	-
	Contingency Allowance	25%		$	-
Total Annual O&M Cost (Rounded to Nearest $1,000)				**$**	**-**

99 Year Cost Projection (Discount Rate: 7%)		
Total Capital Costs	$	17,907,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)		$0.00
Total Cost: Alternative 2 (Rounded to nearest $10,000)	**$**	**17,910,000**

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-4 OU-2 REMOVAL ALTERNATIVE 2 - PRELIMINARY CONSTRUCTION COST ESTIMATE

Removal of Slag Piles to an Existing Off-Site Landfill; and ICs

No.	Assumptions
1	The 60,900 CY of slag fails toxicity characteristic leaching procedure (TCLP) test for leachability and must be stabilized prior to disposal in an off-site landfill. Disposal costs are calculated separately and included in the Cost Summary table.
2	The slag waste must be crushed to less than 1-inch median diameter prior to stabilization.
3	Excavation is assumed to include 2-foot thick layer of soil beneath each waste pile for an additional volume of 20,800 CY. Based on TCLP results for residential soil, this waste is assumed to be non-hazardous contaminated waste and not subject to land disposal restrictions (i.e., no stabilization required).
4	A maximum of 100 trucks per day could be loaded for transport to a landfill.
5	The closest existing landfill permitted to accept the waste is U.S. Ecology's facility in Beatty, Nevada. Approximately 10.5 hours round trip trucking time including loading/unloading. No per diem or overnight stay for truck drivers is included.
6	Excavation and disposal can be completed in one construction season.
7	Requires a 12 person crew working 6 days per week. Minimum of 52 days of hauling at 100 trucks/day.
8	Bank stabilization and rip rap armoring is necessary to prevent the unnamed creeks in Eureka from eroding the western side of the Richmond Company Smelter (RCS) slag pile and northwest side of Eureka Consolidated Smelter (ECS) slag pile. Additionally, it was assumed that a protective liner (80-mil textured HDPE with 2-layers 12oz/SY geotextile) or similar equivalent is necessary in the creeks adjacent to the piles to prevent scour and limit infiltration of water into any remaining waste piles.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	6	per MO	$ 34,800	$ 208,800
C1b	Plans and Submittals	1	Lump Sum	$ 75,000	$ 75,000
C1c	Mobilization/Demobilization	2	per Occurrence	$ 21,900	$ 43,800
C1d	Travel, Lodging and Per Diem	72	EA Person per MO	$ 4,995	$ 359,640
	Subtotal General Costs				*$ 687,240*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	300	per LF	$ 7	$ 2,100
C2b	Clearing	1	per Acre	$ 2,200	$ 1,100
C2c	Land surveying	3	per Occurrence	$ 11,900	$ 35,700
	Subtotal Clearing and Surveying				*$ 38,900*
Earthwork Costs:					
C3a	General Excavation (excavate and load onto trucks)	81,700	per CY	$ 13	$ 1,062,100
C3b	General Backfill (import and place backfill)	20,800	per CY	$ 15	$ 312,000
C3c	Utility Excavation and Backfill	415	per CY	$ 92	$ 38,200
C3d	On-Site Transportation	0	per CY	$ 8	$ -
C3e	Site Restoration	8	per Acre	$ 5,816	$ 46,600
C3f	Erosion and Sediment Control	8	per Acre-Year	$ 3,300	$ 26,400
C3g	Geotechnical Field Work and Reporting	2	per Report	$ 10,600	$ 21,200
C3h	Analytical and Field Monitoring	38,720	per SY	$ 4	$ 162,700
C3i					
C3j	Eureka Creek Sloping and Rip Rap Armoring	1	Lump Sum	$ 138,947	$ 139,000
	Subtotal Earthwork Costs				*$ 1,808,200*

Table B-4 **OU-2 REMOVAL ALTERNATIVE 2 - PRELIMINARY CONSTRUCTION COST ESTIMATE**

Removal of Slag Piles to an Existing Off-Site Landfill; and ICs

Transportation, Disposal and Cover Costs:					
C4a	Off-Site Disposal of Non-Hazardous Contaminated Soil in Existing Landfill	0	per Ton	$ 106	$ -
C4b	Crushing, Off-site Disposal w/Stabilization of Slag, (RCRA Hazardous waste and Land Disposal Restrictions),	0	per Ton	$ 163	$ -
C4e	On-Site Soil Cover	0	per SY	$ 15	$ -
C4f	Construction of Waste Cell	0	per SY	$ 27	$ -
	Subtotal Transportation and Disposal Costs				***$ -***
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 2,534,000***

Indirect Capital Costs					
	Permitting/Planning/Institutional Controls	6%			$ 152,040
	Professional/Tech. - Project Management	3%			$ 76,020
	Professional/Tech. - Remedial Design	3%			$ 76,020
	Professional/Tech. - Construction Mgmt	4%			$ 101,360
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 405,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 2,939,000*
	Contingency Allowance	10%			$ 293,900
Total Capital Cost (Rounded to Nearest $1,000)					**$ 3,233,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection	0	per Year	$ 12,000	$ -
O1b	Fence Maintenance	0	per Year	$ 1,704	$ -
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ -*
Annual Indirect O&M Costs					
	Administration	5%			$ -
	Insurance, Taxes, Licenses	3%			$ -
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ -*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ -*
	Contingency Allowance	25%			$ -
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ -**

99 Year Cost Projection (Discount Rate: 7%)	
Total Capital Costs	$ 3,233,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$ -
Total Cost: Alternative 2 (Rounded to nearest $10,000)	**$ 3,230,000**

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-5 **OU-2 REMOVAL ALTERNATIVE 3 - PRELIMINARY CONSTRUCTION COST ESTIMATE**

Consolidation, Grading, and In-Place Capping of Slag Piles with a 2 Foot Soil Cover; and ICs

No.	Assumptions
1	There are approximately 60,900 CY of slag in the four piles with a total area of approximately 6.5 acres. Restoration work occurs over 8 acres to account for equipment storage and import material laydown (stockpile) areas.
2	Bank stabilization and rip rap armoring is necessary to prevent the unnamed creeks in Eureka from eroding the western side of the Richmond Company Smelter (RCS) slag pile and northwest side of Eureka Consolidated Smelter (ECS) slag pile. Additionally, it was assumed that a protective liner (80-mil textured HDPE with 2-layers 12oz/SY geotextile) or equivalent is necessary in the creeks adjacent to the piles to prevent scour and limit infiltration of water into any remaining waste piles.
3	All work can be completed in one 6-month construction season by a 12 person crew.
4	Approximately 10,000 cubic yards of material will need to be excavated and moved to other parts of the site(s) to promote continuous slope/drainage and minimize cover material.
5	Onsite transport and backfill includes resloping piles to slopes less than 3:1 horizontal to vertical.
6	Slag Piles would be capped with 2 feet of clean imported fill material. Based on EPA's experience during residential removal actions, f ill is assumed to come from a source located within 25 minutes drive time of the site.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	6	per MO	$ 34,800	$ 208,800
C1b	Plans and Submittals	1	Lump Sum	$ 75,000	$ 75,000
C1c	Mobilization/Demobilization	2	per Occurrence	$ 21,900	$ 43,800
C1d	Travel, Lodging and Per Diem	72	EA Person per MO	$ 4,995	$ 359,640
	Subtotal General Costs				*$ 687,240*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	3,000	per LF	$ 7	$ 21,000
C2b	Clearing	1	per Acre	$ 2,200	$ 1,100
C2c	Land surveying	2	per Occurrence	$ 11,900	$ 23,800
	Subtotal Clearing and Surveying				*$ 45,900*
Earthwork Costs:					
C3a	General Excavation (excavate, load, transport on-site)	10,000	per CY	$ 13	$ 130,000
C3b	General Backfill (place and compact fill)	10,000	per CY	$ 10	$ 100,000
C3c	Utility Excavation and Backfill	415	per CY	$ 92	$ 38,200
C3d	On-Site Transportation	10,000	per CY	$ 8	$ 80,000
C3e	Site Restoration	8	per Acre	$ 5,816	$ 46,600
C3f	Erosion and Sediment Control	8	per Acre-Year	$ 3,300	$ 26,400
C3g	Geotechnical Field Work and Reporting	1	per Report	$ 10,600	$ 10,600
C3h	Analytical and Field Air Monitoring	38,720	per SY	$ 4	$ 162,700
C3j	Eureka Creek Sloping and Armoring	1	Lump Sum	$ 138,947	$ 139,000
	Subtotal Earthwork Costs				*$ 733,500*

Table B-5 **OU-2 REMOVAL ALTERNATIVE 3 - PRELIMINARY CONSTRUCTION COST ESTIMATE**

Consolidation, Grading, and In-Place Capping of Slag Piles with a 2 Foot Soil Cover; and ICs

Transportation, Disposal and Cover Costs:					
C4a	Off-Site Disposal of PAL Soil	0	per Ton	$ 106	$ -
C4b	Off-Site Disposal of PTW Soil	0	per Ton	$ 163	$ -
C4e	On-Site Soil Cover, 2-foot thick	31,460	per SY	$ 15	$ 471,900
	Subtotal Transportation and Disposal Costs				*$ 471,900*
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 1,939,000***
Indirect Capital Costs					
	Permitting/Planning/Institutional Controls	6%			$ 116,340
	Professional/Tech. - Project Management	4%			$ 77,560
	Professional/Tech. - Remedial Design	5%			$ 96,950
	Professional/Tech. - Construction Mgmt	6%			$ 116,340
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 407,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 2,346,000*
	Contingency Allowance	10%			$ 234,600
Total Capital Cost (Rounded to Nearest $1,000)					**$ 2,581,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection	4	per Year	$ 12,000	$ 48,000
O1b	Fence & BMP Maintenance	4	per Year	$ 1,704	$ 6,816
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ 55,000*
Annual Indirect O&M Costs					
	Administration	5%			$ 2,750
	Insurance, Taxes, Licenses	3%			$ 1,375
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ 4,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ 59,000*
	Contingency Allowance	15%			$ 8,850
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ 68,000**

99 Year Cost Projection (Discount Rate: 7%)	
Total Capital Costs	$ 2,581,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$ 970,000
Total Cost: Alternative 2 (Rounded to nearest $10,000)	**$ 3,550,000**

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-6 **OU-2 REMOVAL ALTERNATIVE 4 - PRELIMINARY CONSTRUCTION COST ESTIMATE**

Limited Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with a 2 Foot Soil Cover; and ICs

No.	Assumptions
1	There are approximately 60,900 CY of slag in the four piles with a total area of approximately 6.5 acres. Restoration work occurs over 8 acres to account for equipment storage and import material laydown (stockpile) areas.
2	Bank stabilization and rip rap armoring are necessary to prevent the unnamed creeks in Eureka from eroding the western side of the Richmond Company Smelter (RCS) slag pile and northwest side of Eureka Consolidated Smelter (ECS) slag pile. Additionally, it was assumed that a protective liner (80-mil textured HDPE with 2-layers 12oz/SY geotextile) or similar equivalent is necessary in the creeks adjacent to the piles to prevent scour and limit infiltration of water into any remaining waste piles.
3	Approximately 5,000 CY of soil or slag from the Atlas and Matamoras Slag Piles would be hauled to the RCS or ECS slag piles and consolidated. Costs for loading and transporting the soil for up to 1 mile are included herein. One truckload is assumed to be 16 CY.
4	Approximately 10,000 cubic yards of material will need to be excavated and moved to other parts of the site(s) to promote continuous slope/drainage and minimize cover material.
5	On-site transport and backfill includes resloping piles to slopes less than 3:1 horizontal to vertical.
6	Slag piles would be capped with 2 feet of clean imported fill material. Based on EPA's experience during residential removal actions, fill is assumed to come from a source located within 25 minutes drive time of the Site.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	6	per MO	$ 34,800	$ 208,800
C1b	Plans and Submittals	1	Lump Sum	$ 75,000	$ 75,000
C1c	Mobilization/Demobilization	2	per Occurrence	$ 21,900	$ 43,800
C1d	Travel, Lodging and Per Diem	72	EA Person per MO	$ 4,995	$ 359,640
	Subtotal General Costs				*$ 687,240*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	3,000	per LF	$ 7	$ 21,000
C2b	Clearing	1	per Acre	$ 2,200	$ 1,100
C2c	Land surveying	2	per Occurrence	$ 11,900	$ 23,800
	Subtotal Clearing and Surveying				*$ 45,900*
Earthwork Costs:					
C3a	General Excavation (excavate, load, transport on-site)	10,000	per CY	$ 13	$ 130,000
C3b	General Backfill (regrade/place and compact imported slag)	10,000	per CY	$ 10	$ 100,000
C3c	Utility Excavation and Backfill	415	per CY	$ 92	$ 38,200
C3d	On-Site Transportation	5,000	per CY	$ 8	$ 40,000
C3e	Site Restoration	10	per Acre	$ 5,816	$ 58,200
C3f	Erosion and Sediment Control	10	per Acre-Year	$ 3,300	$ 33,000
C3g	Geotechnical Field Work and Reporting	1	per Report	$ 10,600	$ 10,600
C3h	Analytical and Field Air Monitoring	48,400	per SY	$ 4	$ 203,300
C3j	Eureka Creek Sloping and Armoring	1	Lump Sum	$ 138,947	$ 139,000
	Subtotal Earthwork Costs				*$ 752,300*

Table B-6 **OU-2 REMOVAL ALTERNATIVE 4 - PRELIMINARY CONSTRUCTION COST ESTIMATE**

Limited Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with a 2 Foot Soil Cover; and ICs

Transportation, Disposal and Cover Costs:					
C4a	Off-Site Disposal of PAL Soil	0	per Ton	$ 106	$ -
C4b	Off-Site Disposal of PTW Soil	0	per Ton	$ 163	$ -
C4d	Load & Transport Material to the Slag Piles	5,000	per CY	$ 10	$ 51,800
C4e	On-Site Soil Cover, 2-foot thick	31,460	per SY	$ 15	$ 471,900
C4f	Construction of Waste Cell	0	per SY	$ 27	$ -
	Subtotal Transportation and Disposal Costs				*$ 523,700*
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 2,009,000***

Indirect Capital Costs					
	Permitting/Planning/Institutional Controls	6%			$ 120,540
	Professional/Tech. - Project Management	4%			$ 80,360
	Professional/Tech. - Remedial Design	5%			$ 100,450
	Professional/Tech. - Construction Mgmt	6%			$ 120,540
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 422,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 2,431,000*
	Contingency Allowance	10%			$ 243,100
Total Capital Cost (Rounded to Nearest $1,000)					**$ 2,674,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection	4	per Year	$ 12,000	$ 48,000
O1b	Fence & BMP Maintenance	4	per Year	$ 1,704	$ 6,816
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ 55,000*
Annual Indirect O&M Costs					
	Administration	5%			$ 2,750
	Insurance, Taxes, Licenses	3%			$ 1,375
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ 4,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ 59,000*
	Contingency Allowance	15%			$ 8,850
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ 68,000**

99 Year Cost Projection (Discount Rate: 7%)	
Total Capital Costs	$ 2,674,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$ 970,000
Total Cost: Alternative 2 (Rounded to nearest $10,000)	**$ 3,640,000**

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-7 OU-2 REMOVAL ALTERNATIVE 5 - PRELIMINARY CONSTRUCTION COST ESTIMATE

Maximized Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with a 2-Foot Soil Cover; and ICs

No.	Assumptions
1	Maximum capacity of the Richmond Company Smelter (RCS) and Eureka Consolidated Smelter (ECS) slag piles is 13,000 CY each for a total waste capacity of 26,000 CY
2	Grading and filling of voids and/or holes and or low spots will occur concurrently with the import of waste.
3	Bank stabilization and rip rap armoring is necessary to prevent the unnamed creek in Eureka from eroding the western side of the RCS slag pile and northwest side of ECS slag pile. Additionally, it was assumed that a protective liner (80-mil textured HDPE with 2-layers 12oz/SY geotextile) or similar equivalent is necessary to prevent scour and limit infiltration of water into piles.
4	Soil for cap material can be purchased locally for $10/ton delivered.
5	Construction of one slag pile repository per year, 4 months per cell, 15 person crew average.
6	Total project area is approximately 8 acres to account for equipment storage and laydown areas..

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	8	per MO	$ 34,800	$ 278,400
C1b	Plans and Submittals	1	Lump Sum	$ 150,000	$ 150,000
C1c	Mobilization/Demobilization	4	per Occurrence	$ 21,900	$ 87,600
C1d	Travel, Lodging and Per Diem	96	EA Person per MO	$ 4,995	$ 479,520
	Subtotal General Costs				***$ 995,520***
General Site Work Costs:					
C2a	Fence Construction/Repair	4,000	per LF	$ 30	$ 120,000
C2b	Clearing	2	per Acre	$ 2,200	$ 4,400
C2c	Land surveying	4	per Occurrence	$ 11,900	$ 47,600
C2d	Install 6 Monitoring wells	2	per occurrence	$ 42,379	$ 84,800
	Subtotal Clearing and Surveying				***$ 256,800***
Earthwork Costs:					
C3a	General Grading of Slag Piles	5,000	per CY	$ 13	$ 65,000
C3b	General Backfill regrade/place and compact imported slag)	26,000	per CY	$ 10	$ 260,000
C3c	Utility/anchor Trench Excavation and Backfill	250	per CY	$ 92	$ 23,000
C3d	On-Site Transportation	5,000	per CY	$ 8	$ 40,000
C3e	Site Restoration	10	per Acre	$ 5,816	$ 58,200
C3f	Erosion and Sediment Control	10	per Acre-Year	$ 3,300	$ 33,000
C3g	Geotechnical Field Work and Reporting	2	per Report	$ 10,600	$ 21,200
C3h	Analytical and Particulate Monitoring	48,400	per SY	$ 4	$ 203,300
	Subtotal Earthwork Costs				***$ 703,700***
Transportation, Disposal and Liner/Cover Costs:					
C4a	Construct Liner adjacent to Creeks	2,400	per SY	$ 30	$ 72,000
C4b	Stream Bank Stabilization and Rip rap	1	LS	$ 138,947	$ 139,000
C4e	On-Site Soil Cover (see C3b)	48,400	per SY	$ 15	$ 726,000
C4d	Load & Transport Material to the Slag Piles	26,000	per CY	$ 10	$ 269,100
C4f	Construction of Waste Cell-spread, moisture condition, and compact in 1-foot lifts	48,400	per SY	$ 6	$ 280,800
	Subtotal Transportation and Disposal Costs				***$ 1,486,900***
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 3,443,000***

Table B-7 **OU-2 REMOVAL ALTERNATIVE 5 - PRELIMINARY CONSTRUCTION COST ESTIMATE**
Maximized Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with a 2-Foot Soil Cover; and ICs

Item	Description	Quantity	Unit	Cost/Unit	Cost
Indirect Capital Costs					
	Permitting/Planning/Institutional Controls	6%			$ 206,580
	Professional/Tech. - Project Management	4%			$ 137,720
	Professional/Tech. - Remedial Design	3%			$ 103,290
	Professional/Tech. - Construction Mgmt	3%			$ 103,290
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 551,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 3,994,000*
	Contingency Allowance	10%			$ 399,400
Total Capital Cost (Rounded to Nearest $1,000)					**$ 4,393,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection and Monitoring well sampling	4	per Year	$ 12,000	$ 48,000
O1b	Fence Inspection and Maintenance	4	per Year	$ 1,704	$ 6,816
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ 55,000*
Annual Indirect O&M Costs					
	Administration	5%			$ 2,750
	Insurance, Taxes, Licenses	3%			$ 1,375
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ 4,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ 59,000*
	Contingency Allowance	25%			$ 14,750
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ 74,000**

99 Year Cost Projection (Discount Rate: 7%)	
Total Capital Costs	$ 4,393,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$ 1,056,000
Total Cost: Alternative 2 (Rounded to nearest $10,000)	**$ 5,450,000**

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-8 OU-3 REMOVAL ALTERNATIVE 2 - PRELIMINARY CONSTRUCTION COST ESTIMATE

Smelter and Mill Footprint Area 1 Foot Soil Excavation and Removal with 1 Foot Soil and/or Rock Cover on >10% Slopes; and ICs

No.	Assumptions
1	There are approximately 33,252 CY of contaminated soil that would be excavated from the four currently identified Smelter Areas with a total footprint of approximately 20.62 acres. Approximately 17.1 acres within OU-3 are on slopes steeper than about 10 percent and will be backfilled only with rock slope protection (RSP) rather than soil. Approximatley 3.5 acres would be backfilled with 5,735 CY of clean soil.
2	Erosion control measures (hydroseeding, erosion control blankets, additional fiber rolls, etc.) will not be necessary on sloped areas that receive RSP.
3	**The cost to haul and dispose of the contaminated soil is not included in this estimate.** Refer to Cost Summary Table for approximate disposal costs.
4	Work can be completed by a 12-person crew in one 6-month construction season.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	6	per MO	$ 34,800	$ 208,800
C1b	Plans and Submittals	1	Lump Sum	$ 35,000	$ 35,000
C1c	Mobilization/Demobilization	2	per Occurrence	$ 21,900	$ 43,800
C1d	Travel, Lodging and Per Diem	72	EA Person per MO	$ 4,995	$ 359,640
	Subtotal General Costs				*$ 647,240*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	3,000	per LF	$ 7	$ 21,000
C2b	Clearing	21	per Acre	$ 2,200	$ 45,320
C2c	Land surveying	2	per Occurrence	$ 11,900	$ 23,800
	Subtotal Clearing and Surveying				*$ 90,120*
Earthwork Costs:					
C3a	General Excavation (excavate, load, transport on-site)	33,252	per CY	$ 13	$ 432,300
C3b	General Backfill (place and compact fill)	5,736	per CY	$ 10	$ 57,400
C3c	Utility Excavation and Backfill	100	per CY	$ 92	$ 9,200
C3d	On-Site Transportation		per CY	$ 8	$ -
C3e	Site Restoration	21	per Acre	$ 5,816	$ 122,200
C3f	Erosion and Sediment Control for sloped areas (approx. 3.5 ac. of 21 total ac.)	4	per Acre-Year	$ 3,300	$ 11,600
C3g	Geotechnical Field Work and Reporting	1	per Report	$ 10,600	$ 10,600
C3h	Analytical and Field Air Monitoring (Labor and Analytical)	99,704	per SY	$ 4	$ 418,800
	Subtotal Earthwork Costs				*$ 1,062,100*
Transportation, Disposal and Cover Costs:					
C4a	Off-Site Disposal of Non-Haz Soil-not included	0	per Ton	$ 106	$ -
C4b	Off-Site Disposal of RCRA Hazardous Soil-not included	0	per Ton	$ 163	$ -
C4e	On-Site Soil Cover, 1-foot thick (import to site)	7,744	per Ton	$ 9	$ 69,700
C4f	Import and Place 1-foot Rock Slope Protection	82,760	per SY	$ 21	$ 1,738,000
	Subtotal Transportation and Disposal Costs				*$ 1,808,000*
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 3,607,000***
Indirect Capital Costs					

Table B-8 **OU-3 REMOVAL ALTERNATIVE 2 - PRELIMINARY CONSTRUCTION COST ESTIMATE**

Smelter and Mill Footprint Area 1 Foot Soil Excavation and Removal with 1 Foot Soil and/or Rock Cover on >10% Slopes; and ICs

Item	Description	Quantity	Unit	Cost/Unit		Cost
	Permitting/Planning/Institutional Controls	1%			$	36,070
	Professional/Tech. - Project Management	2%			$	72,140
	Professional/Tech. - Remedial Design	1%			$	36,070
	Professional/Tech. - Construction Mgmt	2%			$	72,140
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$*	*216,000*
Total Capital Costs						
	Subtotal Capital Costs				*$*	*3,823,000*
	Contingency Allowance	15%			$	573,450
Total Capital Cost (Rounded to Nearest $1,000)					**$**	**4,396,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**		**Cost**
Annual Direct O&M Costs						
O1a	Cover Inspection	1	per Year	$ 12,000	$	12,000
O1b	Fence & BMP Maintenance	1	per Year	$ 1,704	$	1,704
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$*	*14,000*
Annual Indirect O&M Costs						
	Administration	5%			$	700
	Insurance, Taxes, Licenses	3%			$	350
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$*	*1,000*
Total Annual O&M Costs						
	Subtotal Annual O&M Costs				*$*	*15,000*
	Contingency Allowance	15%			$	2,250
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$**	**17,000**

99 Year Cost Projection (Discount Rate: 7%)		
Total Capital Costs	$	4,396,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$	243,000
Total Cost: Alternative 2 (Rounded to nearest $10,000)	**$**	**4,640,000**

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-9 OU-3 REMOVAL ALTERNATIVE 3 - PRELIMINARY CONSTRUCTION COST ESTIMATE

Smelter and Mill Footprint Area Slope Capping with 1-Foot of Rock (Rock Slope Protection); Limited 1 Foot Soil Excavation and Removal with 1 Foot Soil Cap in Residential Areas; and ICs

No.	Assumptions
1	There are approximately 5,736 CY of contaminated soil within a subset of the combined 21.6 acre Smelter Footprint Area that is considered residential land. This area would be excavated to 1 foot bgs and capped with clean soil. The remaining currently identified Smelter Areas are generally steeply sloped and have a total footprint of approximately 17.1 acres. These area would be capped with 1 foot of rock (rock slope protection).
2	Additional erosion control measures (heavier hydroseeding, erosion control blankets, additional fiber rolls, etc.) will be necessary on sloped areas.
3	**Costs to haul and dispose of the approximately 5,736 CY of excavated residential soil are not included in this estimate.**
4	The cost for 4-inch to 8-inch rock for slope protection is included in this estimate.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	6	per MO	$ 34,800	$ 208,800
C1b	Plans and Submittals	1	Lump Sum	$ 75,000	$ 75,000
C1c	Mobilization/Demobilization	2	per Occurrence	$ 21,900	$ 43,800
C1d	Travel, Lodging and Per Diem	72	EA Person per MO	$ 4,995	$ 359,640
	Subtotal General Costs				*$ 687,240*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	3,000	per LF	$ 7	$ 21,000
C2b	Clearing	3	per Acre	$ 2,200	$ 6,600
C2c	Land surveying	2	per Occurrence	$ 11,900	$ 23,800
	Subtotal Clearing and Surveying				*$ 51,400*
Earthwork Costs:					
C3a	General Excavation (excavate, load, transport locally)	5,736	per CY	$ 13	$ 74,600
C3b	General Backfill (place and compact fill)	5,736	per CY	$ 10	$ 57,400
C3c	Utility Excavation and Backfill	100	per CY	$ 92	$ 9,200
C3d	On-Site Transportation		per CY	$ 8	$ -
C3e	Site Restoration	3	per Acre	$ 5,816	$ 17,500
C3f	Erosion and Sediment Control	3	per Acre-Year	$ 3,300	$ 9,900
C3g	Geotechnical Field Work and Reporting	1	per Report	$ 10,600	$ 10,600
C3h	Analytical and Field Air Monitoring (Labor and Analytical)	88,280	per SY	$ 4	$ 370,800
	Subtotal Earthwork Costs				*$ 550,000*
Transportation, Disposal and Cover Costs:					
C4a	Off-Site Disposal of Non-Haz Soil-not included	0	per Ton	$ 106	$ -
C4b	Off-Site Disposal of RCRA Hazardous Soil-not included	0	per Ton	$ 163	$ -
C4e	On-Site Soil Cover, 1-foot thick (import to site)	7,744	per Ton	$ 9	$ 69,700
C4f	Import and Place 1-foot Rock Slope Protection	82,764	per SY	$ 21	$ 1,738,100
	Subtotal Transportation and Disposal Costs				*$ 1,807,800*
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 3,096,000***

Table B-9 **OU-3 REMOVAL ALTERNATIVE 3 - PRELIMINARY CONSTRUCTION COST ESTIMATE**

Smelter and Mill Footprint Area Slope Capping with 1-Foot of Rock (Rock Slope Protection); Limited 1 Foot Soil Excavation and Removal with 1 Foot Soil Cap in Residential Areas; and ICs

Indirect Capital Costs					
	Permitting/Planning/Institutional Controls	1%			$ 30,960
	Professional/Tech. - Project Management	2%			$ 61,920
	Professional/Tech. - Remedial Design	1%			$ 30,960
	Professional/Tech. - Construction Mgmt	2%			$ 61,920
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 186,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 3,282,000*
	Contingency Allowance	10%			$ 328,200
Total Capital Cost (Rounded to Nearest $1,000)					**$ 3,610,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection	1	per Year	$ 12,000	$ 12,000
O1b	Fence & BMP Maintenance	1	per Year	$ 1,704	$ 1,704
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ 14,000*
Annual Indirect O&M Costs					
	Administration	5%			$ 700
	Insurance, Taxes, Licenses	3%			$ 350
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ 1,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ 15,000*
	Contingency Allowance	15%			$ 2,250
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ 17,000**

99 Year Cost Projection (Discount Rate: 7%)	
Total Capital Costs	$ 3,610,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$ 243,000
Total Cost: Alternative 2 (Rounded to nearest $10,000)	**$ 3,850,000**

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-10 **OU-4 REMOVAL ALTERNATIVE 2 - PRELIMINARY CONSTRUCTION COST ESTIMATE**
Limited Excavation and Removal of 1.5 Feet Soil/Sediments; and Rip Rap Armoring

No.	Assumptions
1	There are approximately 6,200 linear feet of channel impacted by contaminated soil within the Town of Eureka. The creek bed would be excavated to 1.5 feet bgs and capped with 12-inch nominal diameter rock (rip rap) to a depth of 18-inches (1.5 times median diameter of rip rap). Rip rap assumed to weigh 1.75 tons/CY.
2	Soil is assumed to be non-hazardous contaminated waste.
3	Two approximately 8 person crews can excavate in different portions of the creek simultaneously.
4	Crews can excavate and place rip rap in approximately 100 linear feet of channel per day. Average channel bottom cross-section length is 35 feet. Total project can be completed in approximately 90 working days (4 months).
5	Areas of the creek adjacent to the RCS slag pile are not included in this estimate. It was assumed these areas would be addressed as part of the remedial effort to stabilize the pile. Capital costs would increase by approximately 8 percent if this area is included.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	4	per MO	$ 34,800	$ 139,200
C1b	Plans and Submittals	1	Lump Sum	$ 150,000	$ 150,000
C1c	Mobilization/Demobilization	2	per Occurrence	$ 21,900	$ 43,800
C1d	Travel, Lodging and Per Diem	64	EA Person per MO	$ 4,995	$ 319,680
	Subtotal General Costs				*$ 652,680*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	14,000	per LF	$ 7	$ 98,000
C2b	Clearing	3	per Acre	$ 2,200	$ 6,600
C2c	Land surveying	2	per Occurrence	$ 11,900	$ 23,800
	Traffic Control	90	day	$ 2,500	$ 225,000
	Subtotal Clearing and Surveying				*$ 353,400*
Earthwork Costs:					
C3a	General Excavation (excavate, load, transport on-site)	12,028	per CY	$ 13	$ 156,400
C3b	General Backfill (place rip rap)	12,028	per CY	$ 10	$ 120,300
C3c	Utility Excavation and Backfill	100	per CY	$ 92	$ 9,200
C3d	On-Site Transportation		per CY	$ 8	$ -
C3e	Site Restoration	10	per Acre	$ 5,816	$ 58,200
C3f	Erosion and Sediment Control	10	per Acre-Year	$ 3,300	$ 33,000
C3g	Geotechnical Field Work and Reporting	1	per Report	$ 10,600	$ 10,600
C3h	Analytical and Field Air Monitoring (Labor and Analytical)	24,057	per SY	$ 4	$ 101,100
	Subtotal Earthwork Costs				*$ 488,800*
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Transportation, Disposal and Cover Costs:					
C4a	Off-Site Disposal of Non-Haz Soil-not included	0	per Ton	$ 106	$ -
C4b	Off-Site Disposal of RCRA Hazardous Soil-not included	0	per Ton	$ 163	$ -
C4e	On-Site Soil Cover, 1-foot thick (import to site)	0	per Ton	$ 9	$ -
C4f	Import Rock Rip Rap (deliver to site)	21,050	Ton	$ 30	$ 631,500
	Subtotal Transportation and Disposal Costs				*$ 631,500*
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 2,126,000***

Table B-10 OU-4 REMOVAL ALTERNATIVE 2 - PRELIMINARY CONSTRUCTION COST ESTIMATE
Limited Excavation and Removal of 1.5 Feet Soil/Sediments; and Rip Rap Armoring

Indirect Capital Costs					
	Permitting/Planning/Institutional Controls	8%			$ 170,080
	Professional/Tech. - Project Management	3%			$ 63,780
	Professional/Tech. - Remedial Design	5%			$ 106,300
	Professional/Tech. - Construction Mgmt	3%			$ 63,780
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 404,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 2,530,000*
	Contingency Allowance	15%			$ 379,500
Total Capital Cost (Rounded to Nearest $1,000)					**$ 2,910,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection	1	per Year	$ 12,000	$ 12,000
O1b	Fence & BMP Maintenance	4	per Year	$ 1,704	$ 6,816
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ 19,000*
Annual Indirect O&M Costs					
	Administration	5%			$ 950
	Insurance, Taxes, Licenses	3%			$ 475
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ 1,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ 20,000*
	Contingency Allowance	15%			$ 3,000
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ 23,000**

99 Year Cost Projection (Discount Rate: 7%)	
Total Capital Costs	$ 2,910,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$ 328,000
Total Cost: Alternative 2 (Rounded to nearest $10,000)	**$ 3,240,000**

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-11 **OU-4 REMOVAL ALTERNATIVE 3- PRELIMINARY CONSTRUCTION COST ESTIMATE**

Excavation and Removal of 2.5 Feet of Soil/Sediments; In-Place Capping with 1 Foot of Clean Fill; and Rip Rap Armoring

No.	Assumptions
1	There are approximately 6,200 linear feet of channel impacted by contaminated soil within the Town of Eureka. The creek bed would be excavated to 2.5 feet bgs and capped with 1 foot of clean fill and 18-inches of 12-inch nominal diameter rock (rip rap). Rip rap assumed to weigh 1.75 tons/CY. Average bottom width assumed to be 35 feet.
2	Soil is assumed to be non-hazardous contaminated waste.
3	Two approximately 8-person crews can excavate in different portions of the creek simultaneously.
4	Crews can excavate and place rip rap in approximately 80 linear feet of channel per day. Total project can be completed in approximately 105 working days (5 months).
5	Areas of the creek adjacent to the RCS slag pile are not included in this estimate. It was assumed these areas would be addressed as part of the remedial effort to stabilize the pile. Capital costs would increase by approximately 8 percent if this area is included.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	5	per MO	$ 34,800	$ 174,000
C1b	Plans and Submittals	1	Lump Sum	$ 150,000	$ 150,000
C1c	Mobilization/Demobilization	2	per Occurrence	$ 21,900	$ 43,800
C1d	Travel, Lodging and Per Diem	80	EA Person per MO	$ 4,995	$ 399,600
	Subtotal General Costs				*$ 767,400*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	14,000	per LF	$ 7	$ 98,000
C2b	Clearing	3	per Acre	$ 2,200	$ 6,600
C2c	Land surveying	2	per Occurrence	$ 11,900	$ 23,800
	Traffic Control	90	day	$ 2,500	$ 225,000
	Subtotal Clearing and Surveying				*$ 353,400*
Earthwork Costs:					
C3a	General Excavation (excavate, load, transport on-site)	20,047	per CY	$ 13	$ 260,700
C3b	General Backfill (place rip rap and/or soil)	20,047	per CY	$ 10	$ 200,500
C3c	Utility Excavation and Backfill	100	per CY	$ 92	$ 9,200
C3d	On-Site Transportation		per CY	$ 8	$ -
C3e	Site Restoration	10	per Acre	$ 5,816	$ 58,200
C3f	Erosion and Sediment Control	10	per Acre-Year	$ 3,300	$ 33,000
C3g	Geotechnical Field Work and Reporting	1	per Report	$ 10,600	$ 10,600
C3h	Analytical and Field Air Monitoring (Labor and Analytical)	24,057	per SY	$ 4	$ 101,100
	Subtotal Earthwork Costs				*$ 673,300*
Transportation, Disposal and Cover Costs:					
C4a	Off-Site Disposal of Non-Haz Soil-not included	0	per Ton	$ 106	$ -
C4b	Off-Site Disposal of RCRA Hazardous Soil-not included	0	per Ton	$ 163	$ -
C4e	On-Site Soil Cover, 1-foot-thick (import to site)	10,826	per Ton	$ 9	$ 97,500
C4f	Import Rock Rip Rap (deliver to site)	21,050	Ton	$ 30	$ 631,500
	Subtotal Transportation and Disposal Costs				*$ 729,000*
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 2,523,000***

Indirect Capital Costs				
	Permitting/Planning/Institutional Controls	8%		$ 201,840
	Professional/Tech. - Project Management	3%		$ 75,690
	Professional/Tech. - Remedial Design	6%		$ 151,380
	Professional/Tech. - Construction Mgmt	3%		$ 75,690
Total Indirect Capital Costs (Rounded to Nearest $1,000)				*$ 505,000*

Table B-11 **OU-4 REMOVAL ALTERNATIVE 3- PRELIMINARY CONSTRUCTION COST ESTIMATE**

Excavation and Removal of 2.5 Feet of Soil/Sediments; In-Place Capping with 1 Foot of Clean Fill; and Rip Rap Armoring

Total Capital Costs					
	Subtotal Capital Costs				*$ 3,028,000*
	Contingency Allowance	15%			$ 454,200
Total Capital Cost (Rounded to Nearest $1,000)					**$ 3,482,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection	1	per Year	$ 12,000	$ 12,000
O1b	Fence & BMP Maintenance	4	per Year	$ 1,704	$ 6,816
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ 19,000*
Annual Indirect O&M Costs					
	Administration	5%			$ 950
	Insurance, Taxes, Licenses	3%			$ 475
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ 1,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ 20,000*
	Contingency Allowance	15%			$ 3,000
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ 23,000**

99 Year Cost Projection (Discount Rate: 7%)	
Total Capital Costs	$ 3,482,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$ 328,000
Total Cost: Alternative 2 (Rounded to nearest $10,000)	**$ 3,810,000**

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-12 OU-5 DISPOSAL ALTERNATIVE 1 - PRELIMINARY CONSTRUCTION COST ESTIMATE
Offsite Disposal of Removal Waste at an Existing Landfill

No.	Assumptions
1	Soil removal disposal volume for non-hazardous soil (soil from OU-1, OU-3 and OU-4) is 137,500 CY. RCRA Hazardous Waste volume requiring crushing and stabilization is 60,900 CY. Because it appears unlikely that, except in limited circumstances, soil would be able to be loaded directly into trucks, it was assumed that 50 percent of the total volume (including the existing 10,600 CY stockpile) would need to be stockpiled prior to disposal. This requires additional handling (stockpile management and loading of trucks) and additional mobilizations, especially for soils removed from OU-1, OU-3, and OU-4 (i.e., it was assumed that more of the soil from OU-2 could be loaded directly into trucks). These estimated costs are included in this cost worksheet.
2	Hauling of soil was assumed to be an intermittent task that periodically occurs concurrently with soil removal and therefore monthly costs for "Field Overhead and Oversight" are not included in the costs in this estimate. They are included in the respective estimates for each alternative. Similarly, indirect capitol costs for management, design, permitting/planning etc. are greatly reduced. Additional mobilizations for equipment are included.
3	A maximum of 100 trucks per day could be loaded for transport to a landfill. It is assumed that this volume of trucking is only possible while loading from an existing stockpile (i.e., 50 percent of the soil would be hauled at 100 trucks per day). It is also assumed that if this volume of trucking occurs, traffic control would be required on those days. Based on an average per truck volume of 24 tons per load the total disposal volume equates to 11,540 truckloads. Therefore, traffic control would be required for 11,540 loads/100 loads per day*1/2=5,771 truckloads loaded from a stockpile= 58 working days of traffic control.
4	Residential soil (OU-1), soil beneath the slag piles (OU-2), Smelter soil (OU-3), and Creek soil (OU-4), are assumed to be non-hazardous and are not subject to land disposal restrictions (i.e., it does not require stabilization prior to disposal). Slag is assumed to fail maximum regulatory toxicity characteristic leaching procedure (TCLP) levels and require crushing and stabilization prior to disposal.
5	Costs include loading, hauling, and disposal of the existing 10,600 CY stockpile.
6	Stockpiles may remain during the winter non-construction season. Therefore, costs to cover and/or otherwise implement storm water controls are included in this estimate for four construction seasons. However, it was assumed that there are no long term operation and maintenance costs associated with off-site disposal.
7	Soil weighs approximately 1.35 tons per CY, slag weighs approximately 1.5 tons per CY.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	0	per MO	$ 34,800	$ -
C1b	Plans and Submittals	1	Lump Sum	$ 15,000	$ 15,000
C1c	Mobilization/Demobilization	8	per Occurrence	$ 11,000	$ 88,000
C1d	Travel, Lodging and Per Diem	0	EA Person per MO	$ 4,995	$ -
	Subtotal General Costs				*$ 103,000*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	0	per LF	$ 30	$ -
C2b	Clearing	0	per Acre	$ 2,200	$ -
	Traffic Control	58	per Day	$ 2,500	$ 145,000
C2c	Land surveying	0	per Occurrence	$ 11,900	$ -
	Subtotal Clearing and Surveying				*$ 145,000*
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Earthwork Costs:					
C3a	General Excavation (Load stockpiles onto trucks)	98,102	per CY	$ 4	$ 392,500
C3b	General Backfill (import and place backfill)	0	per CY	$ 10	$ -
C3c	Utility Excavation and Backfill	0	per CY	$ 92	$ -
C3d	On-Site Transportation	0	per CY	$ 8	$ -
C3e	Site Restoration	0	per Acre	$ 5,816	$ -
C3f	Erosion and Sediment Control	0	per Acre-Year	$ 3,300	$ -
C3g	Geotechnical Field Work and Reporting	0	per Report	$ 10,600	$ -
C3h	Analytical and Field Monitoring	196,204	per CY	$ 1	$ 196,300
	Subtotal Earthwork Costs				*$ 588,800*

Table B-12 **OU-5 DISPOSAL ALTERNATIVE 1 - PRELIMINARY CONSTRUCTION COST ESTIMATE**
Offsite Disposal of Removal Waste at an Existing Landfill

Transportation, Disposal and Cover Costs:					
C4a	Off-Site Disposal of Non-Hazardous Contaminated Soil at US Ecology, Beatty NV (Transport and Disposal) 137,500 CY at 1.35 tons per CY =185,625 Tons	185,625	per Ton	$ 106	$ 19,676,300
C4b	Crushing, Off-site Disposal w/Stabilization of Slag, (RCRA Hazardous waste and Land Disposal Restrictions) 60,900 CY of slag at 1.50 tons per CY = 91,350 Tons	91,350	per Ton	$ 163	$ 14,853,600
	Subtotal Transportation and Disposal Costs				*$ 34,530,000*
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 35,367,000***
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Indirect Capital Costs					
	Permitting/Planning/Institutional Controls	1%			$ 8,371
	Professional/Tech. - Project Management	2%			$ 16,742
	Professional/Tech. - Remedial Design	1%			$ 8,371
	Professional/Tech. - Construction Mgmt	2%			$ 16,742
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 50,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 35,417,000*
	Contingency Allowance	5%			$ 1,770,850
Total Capital Cost (Rounded to Nearest $1,000)					**$ 37,188,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection	0	per Year	$ 12,000	$ -
O1b	Fence Maintenance		per Year	$ 1,704	$ -
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ -*
Annual Indirect O&M Costs					
	Administration	5%			$ -
	Insurance, Taxes, Licenses	3%			$ -
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ -*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ -*
	Contingency Allowance	25%			$ -
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ -**

99 Year Cost Projection (Discount Rate: 7%)	
Total Capital Costs	$ 37,188,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$0.00
Total Cost: Alternative 2 (Rounded to nearest $10,000)	**$ 37,190,000**
Approximate cost per CY for Non-Haz Soil	**$ 154**
Approximate cost per CY for RCRA-Haz Slag	**$ 263**
	$ 187.83

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot

Table B-13 OU-5 DISPOSAL ALTERNATIVE 2 - PRELIMINARY CONSTRUCTION COST ESTIMATE
Disposal of Soil at a Locally Constructed Landfill, and Offsite Disposal of Slag Piles at an Existing Landfill Facility

No.	Assumptions
1	Slag would be crushed, stabilized and disposed of at an existing off-site landfill. The maximum anticipated volume of soil is placed in the local repository is 137,500 CY. The estimated areal footprint of such a repository is 8.8 acres. Soil beneath the slag pile wastes does not need to be stabilized or otherwise treated prior to disposal in a local landfill.
2	Repository would be constructed in cells over four construction seasons as various removal actions occur. Active work would occur for approximately 3 months per year, for a total of 12 working months for a crew of 8 persons.
3	No special permitting or environmental assessments are necessary.
4	A 2,350-foot-long channel would need to be constructed to route clean water around the base of the pile. The channel would be lined with rock to prevent erosion. The channel is assumed to be 3 feet deep with a 4-foot bottom width and 3:1 H:V sides slopes. A 1-foot thick layer of 4-inch to 8-inch rock would be placed in the channel. No hydrologic or hydraulic analysis has been performed to verify these assumptions and the exact location of the landfill has not been selected. Therefore the size and length of the channel are also assumptions.
5	Soil excavated to construct the drainage channel would be used as temporary cap material.
6	A 4-foot thick evapotranspiration (ET) cap would be constructed over the waste pile and no liner would be necessary. Sides slopes would be no
7	Costs for hauling waste to the repository are included in the residential disposal estimates.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	12	per MO	$ 34,800	$ 417,600
C1b	Plans and Submittals	1	Lump Sum	$ 75,000	$ 75,000
C1c	Mobilization/Demobilization	8	per Occurrence	$ 21,900	$ 175,200
C1d	Travel, Lodging and Per Diem	96	EA Person per MO	$ 4,995	$ 479,520
	Subtotal General Costs				*$ 1,147,320*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	10,000	per LF	$ 7	$ 70,000
C2b	Clearing	9	per Acre	$ 2,200	$ 19,800
C2c	Land surveying	5	per Occurrence	$ 11,900	$ 59,500
	Subtotal Clearing and Surveying				*$ 149,300*
Earthwork Costs:					
C3a	Place and Compact Waste Soil 5% expansion factor =1.05*137,500=144,400 CY	144,400	per CY	$ 10	$ 1,444,000
C3b	General Backfill (import and place backfill)		per CY	$ 15	$ -
C3c	Utility Excavation and Backfill	415	per CY	$ 92	$ 38,200
C3d	On-Site Transportation	0	per CY	$ 8	$ -
C3e	Site Restoration	9	per Acre	$ 5,816	$ 52,400
C3f	Erosion and Sediment Control	36	per Acre-Year	$ 3,300	$ 118,800

Item	Description	Quantity	Unit	Cost/Unit	Cost
C3g	Geotechnical Field Work and Reporting	4	per Report	$ 10,600	$ 42,400
C3h	Analytical and Field Monitoring	43,560	per SY	$ 4	$ 183,000
	Retaining Wall Construction		per SF	$ 31	$ -
C3j	Channel Excavation	3,400	per CY	$ 13	$ 44,200
	Subtotal Earthwork Costs				*$ 1,923,000*
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Transportation, Disposal and Cover Costs:					
C4f	Channel construction-Import and place rock rip rap.	6,270	per SY	$ 21	$ 131,700
C4j	Construct 4-foot thick ET Cover (import and place backfill)	56,600	per SY	$ 23	$ 1,301,800
	Crushing, Off-site Disposal w/Stabilization of Slag, (RCRA Hazardous waste and Land Disposal Restrictions) 60,900 CY of slag at 1.50 tons per CY = 91,350 Tons	91,350	per ton	$ 163	$ 14,890,050
Slope Steepness Factor on Earthwork and General Site Work					
C4a	Slope Steepness Factor				$ -
	Subtotal Transportation and Disposal Costs				*$ 16,323,550*
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 19,543,000***

Indirect Capital Costs					
	Permitting/Planning/Institutional Controls	3%			$ 586,290
	Professional/Tech. - Project Management	3%			$ 586,290
	Professional/Tech. - Remedial Design	6%			$ 1,172,580
	Professional/Tech. - Construction Mgmt	5%			$ 977,150
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 3,322,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 22,865,000*
	Contingency Allowance	15%			$ 3,429,750
Total Capital Cost (Rounded to Nearest $1,000)					**$ 26,295,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection and Maintenance	4	per Year	$ 12,000	$ 48,000
O1b	Fence Maintenance	0	per Year	$ 1,704	$ -
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ 48,000*
Annual Indirect O&M Costs					
	Administration	5%			$ 2,400
	Insurance, Taxes, Licenses	3%			$ 1,200
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ 4,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ 52,000*
	Contingency Allowance	30%			$ 15,600
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ 68,000**

99 Year Cost Projection (Discount Rate: 7%)		
Total Capital Costs	$	26,295,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$	970,000
Total Cost: OU-5 Alternative 3A (Rounded to nearest $10,000)	**$**	**27,270,000**
Approx. Cost per CY for Disposal	$	137.00

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-14 **OU-5 DISPOSAL ALTERNATIVE 3A - PRELIMINARY CONSTRUCTION COST ESTIMATE**
Disposal of Maximum Estimated Soil from OU-1, OU-3, and OU-4 at a Locally Constructed Landfill

No.	Assumptions
1	Niether slag or contaminated soil currently beneath the slag would not be placed in the repository. The maximum anticipated volume of soil is 114,500 CY. The estimated areal footprint of such a repository is 7 acres (9 acres of clearing and restoration).
2	Repository would be constructed in cells over four construction seasons as various removal actions occur. Active work would occur for approximately 3 months per year, for a total of 12 working months for a crew of 8 persons.
3	No special permitting or environmental assessments are necessary.
4	A 2,000-foot-long channel would need to be constructed to route clean water around the base of the pile. The channel would be lined with rock to prevent erosion. The channel is assumed to be 3 feet deep with a 4-foot bottom width and 3:1 H:V sides slopes. A 1-foot thick layer of 4-inch to 8-inch rock would be placed in the channel. No hydrologic or hydraulic analysis has been performed to verify these assumptions and the exact location of the landfill has not been selected. Therefore the length of the channel is also an assumption.
5	Soil excavated to construct the drainage channel would be used as temporary cap material.
6	A 4-foot-thick evapotranspiration (ET) cap would be constructed over the waste pile and no liner would be necessary. Sides slopes would be no
7	Costs for hauling waste to the repository are included in the residential disposal estimates.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	12	per MO	$ 34,800	$ 417,600
C1b	Plans and Submittals	1	Lump Sum	$ 75,000	$ 75,000
C1c	Mobilization/Demobilization	8	per Occurrence	$ 21,900	$ 175,200
C1d	Travel, Lodging and Per Diem	96	EA Person per MO	$ 4,995	$ 479,520
	Subtotal General Costs				*$ 1,147,320*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	10,000	per LF	$ 7	$ 70,000
C2b	Clearing	9	per Acre	$ 2,200	$ 19,800
C2c	Land surveying	5	per Occurrence	$ 11,900	$ 59,500
	Subtotal Clearing and Surveying				*$ 149,300*
Earthwork Costs:					
C3a	Place and Compact Waste Soil 5% expansion factor =1.05*114,500=119,700 CY	119,700	per CY	$ 10	$ 1,197,000
C3b	General Backfill (import and place backfill)		per CY	$ 15	$ -
C3c	Utility Excavation and Backfill	415	per CY	$ 92	$ 38,200
C3d	On-Site Transportation	0	per CY	$ 8	$ -
C3e	Site Restoration	9	per Acre	$ 5,816	$ 52,400
C3f	Erosion and Sediment Control	36	per Acre-Year	$ 3,300	$ 118,800
C3g	Geotechnical Field Work and Reporting	4	per Report	$ 10,600	$ 42,400
C3h	Analytical and Field Monitoring	43,560	per SY	$ 4	$ 183,000
	Retaining Wall Construction		per SF	$ 31	$ -
C3j	Channel Excavation	3,100	per CY	$ 13	$ 40,300
	Subtotal Earthwork Costs				*$ 1,672,100*
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Transportation, Disposal and Cover Costs:					
C4f	Channel construction-Import and place rock rip rap.	5,640	per SY	$ 21	$ 118,500
C4j	Construct 4-foot thick ET Cover (import and place backfill)	56,600	per SY	$ 23	$ 1,301,800

Table B-14 **OU-5 DISPOSAL ALTERNATIVE 3A - PRELIMINARY CONSTRUCTION COST ESTIMATE**
Disposal of Maximum Estimated Soil from OU-1, OU-3, and OU-4 at a Locally Constructed Landfill

Item	Description	Quantity	Unit	Cost/Unit	Cost
Slope Steepness Factor on Earthwork and General Site Work					
C4a	Slope Steepness Factor				$ -
	Subtotal Transportation and Disposal Costs				*$ 1,420,300*
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 4,389,000***
Indirect Capital Costs					
	Permitting/Planning/Institutional Controls	3%			$ 131,670
	Professional/Tech. - Project Management	3%			$ 131,670
	Professional/Tech. - Remedial Design	6%			$ 263,340
	Professional/Tech. - Construction Mgmt	5%			$ 219,450
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 746,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 5,135,000*
	Contingency Allowance	15%			$ 770,250
Total Capital Cost (Rounded to Nearest $1,000)					**$ 5,905,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection and Maintenance	4	per Year	$ 12,000	$ 48,000
O1b	Fence Maintenance	0	per Year	$ 1,704	$ -
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ 48,000*
Annual Indirect O&M Costs					
	Administration	5%			$ 2,400
	Insurance, Taxes, Licenses	3%			$ 1,200
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ 4,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ 52,000*
	Contingency Allowance	30%			$ 15,600
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ 68,000**

99 Year Cost Projection (Discount Rate: 7%)	
Total Capital Costs	$ 5,905,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$ 970,000
Total Cost: OU-5 Alternative 3A (Rounded to nearest $10,000)	**$ 6,880,000**
Approx. Cost per CY for Disposal	$ 60.00

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-15 **OU-5 DISPOSAL ALTERNATIVE 3B - PRELIMINARY CONSTRUCTION COST ESTIMATE**

Disposal of Residential Soil at a Locally Constructed Landfill

No.	Assumptions
1	Only soil generated during residential removals would be placed in the repository. The maximum anticipated volume of residential soil is 60,200 CY. The estimated aerial footprint of such a repository is 5 acres. Land was assumed to be donated by the County of Eureka or theTown of Eureka and therefore, costs fo land purchase/transfer are not included in this estimate.
2	Repository would be constructed in cells over 3 construction seasons as various removal actions occur. Each mobilization and associated cell construction are assumed to take 2.5 months for a total of 7.5 months for an 8 person average crew size.
3	No special permitting or Environmental assessments are necessary.
4	A 1,500-foot-long channel would need to be constructed to route clean water around the base of the pile. The channel would be lined with rock to prevent erosion. The Channel is assumed to be 3 feet deep with a 4-foot bottom width and 3:1 H:V sides slopes. A 1-foot thick layer of 4-inch to 8-inch rock would be placed in the channel. No hydrologic or hydraulic analysis has been performed to verify these assumptions.
5	Soil excavated to construct the channel would be used as temporary cap material.
6	A 4-foot thick evapotranspiration cap would be constructed over the waste pile. Sides slopes would be no steeper than 4:1 H:V.

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
Field Overhead and Oversight Costs:					
C1a	Field Overhead and Oversight	8	per MO	$ 34,800	$ 261,000
C1b	Plans and Submittals	1	Lump Sum	$ 75,000	$ 75,000
C1c	Mobilization/Demobilization	6	per Occurrence	$ 21,900	$ 131,400
C1d	Travel, Lodging and Per Diem	60	EA Person per MO	$ 4,995	$ 299,700
	Subtotal General Costs				*$ 767,100*
General Site Work Costs:					
C2a	Temporary Fence Construction/Repair	6,000	per LF	$ 7	$ 42,000
C2b	Clearing	5	per Acre	$ 2,200	$ 11,000
C2c	Land surveying	4	per Occurrence	$ 11,900	$ 47,600
	Subtotal Clearing and Surveying				*$ 100,600*
Earthwork Costs:					
C3a	Place and Compact Waste Soil 5% expansion factor =1.05*60,200=63,210 CY	63,210	per CY	$ 10	$ 632,100
C3b	General Backfill (import and place backfill)		per CY	$ 15	$ -
C3c	Utility Excavation and Backfill	415	per CY	$ 92	$ 38,200
C3d	On-Site Transportation	0	per CY	$ 8	$ -
C3e	Site Restoration	5	per Acre	$ 5,816	$ 29,100
C3f	Erosion and Sediment Control	15	per Acre-Year	$ 3,300	$ 49,500
C3g	Geotechnical Field Work and Reporting	3	per Report	$ 10,600	$ 31,800
C3h	Analytical and Field Monitoring	24,200	per SY	$ 4	$ 101,700
	Retaining Wall Construction		per SF	$ 31	$ -
C3j	Channel Excavation	2,166	per CY	$ 13	$ 28,200
	Subtotal Earthwork Costs				*$ 910,600*
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Transportation, Disposal and Cover Costs:					
C4f	Channel construction-Import and place rock rip rap.	4,000	SY	$ 21	$ 84,000
C4j	Construct 4-foot thick ET Cover (import and place backfill)	32,200	per SY	$ 23	$ 740,600

Table B-15 OU-5 DISPOSAL ALTERNATIVE 3B - PRELIMINARY CONSTRUCTION COST ESTIMATE
Disposal of Residential Soil at a Locally Constructed Landfill

Slope Steepness Factor on Earthwork and General Site Work					
C4a	Slope Steepness Factor				$ -
	Subtotal Transportation and Disposal Costs				*$ 824,600*
Total Direct Capital Costs (Rounded to Nearest $1,000)					***$ 2,603,000***

Indirect Capital Costs					
	Permitting/Planning/Institutional Controls	3%			$ 78,090
	Professional/Tech. - Project Management	3%			$ 78,090
	Professional/Tech. - Remedial Design	6%			$ 156,180
	Professional/Tech. - Construction Mgmt	5%			$ 130,150
Total Indirect Capital Costs (Rounded to Nearest $1,000)					*$ 443,000*
Total Capital Costs					
	Subtotal Capital Costs				*$ 3,046,000*
	Contingency Allowance	10%			$ 304,600
Total Capital Cost (Rounded to Nearest $1,000)					**$ 3,351,000**
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
Annual Direct O&M Costs					
O1a	Cover Inspection and Maintenance	4	per Year	$ 12,000	$ 48,000
O1b	Fence Maintenance	0	per Year	$ 1,704	$ -
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$ 48,000*
Annual Indirect O&M Costs					
	Administration	5%			$ 2,400
	Insurance, Taxes, Licenses	3%			$ 1,200
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$ 4,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$ 52,000*
	Contingency Allowance	30%			$ 15,600
Total Annual O&M Cost (Rounded to Nearest $1,000)					**$ 68,000**

99 Year Cost Projection (Discount Rate: 7%)	
Total Capital Costs	$ 3,351,000
Present Worth of 99 Years O&M (Rounded to Nearest $1,000)	$ 970,000
Total Cost: OU-5 Alternative 3 (Rounded to nearest $10,000)	**$ 4,320,000**
Approx. Cost per CY for Disposal	$ 72.00

Key:

CY = Cubic yard
EA = Each
LF = Linear foot
LS = Lump sum
MO = Month
O & M = Operations and maintenance
SF = Square foot
SY = Square Yard

Table B-16
Derived Capital Costs
Project: Town or Eureka EE/CA
Location: Eureka, Eureka County, Nevada
Base Year:2015
Size of Site: Town Of Eureka

ITEM 1 FIELD OVERHEAD AND OVERSIGHT
Derived Cost C1a - Support Structures

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Trailers - 2 unit	1	MO	$ -	$ -	$ 420.51	$ 420.51	$ 421	RSM 01 52 13.20 0350
Storage Boxes - 2 units	1	MO	$ -	$ -	$ 163.78	$ 163.78	$ 164	RSM 01 52 13.20 1250
Field Office Lights/HVAC - 1	1	MO	$ 175.07	$ -	$ -	$ 175.07	$ 175	RSM 01 52 13.40 0160
Telephone/internet	1	MO	$ 93.30	$ -	$ -	$ 93.30	$ 93	RSM 01 52 13.40 0140
Portable Toilet - 4 units	1	MO	$ -	$ -	$ 810.03	$ 810.03	$ 810	RSM 01 54 33.40 6410
Field Office Equipment	1	MO	$ -	$ -	$ 221.32	$ 221.32	$ 221	RSM 01 52 13.40 0100
Field Office Supplies	1	MO	$ 86.39	$ -	$ -	$ 86.39	$ 86	RSM 01 52 13.40 0120
Trash (Month)	1	MO	$ 435.00	$ -	$ -	$ 435.00	$ 435	Engineering Estimate
Air Monitoring Equipment Rental CR-1 [1]	1	MO	$ -	$ -	$ 1,953.15	$ 1,953.15	$ 2,000	Vendor Quote
Air Monitoring Equipment Rental CR-1E [1]	1	MO	$ -	$ -	$ 1,953.15	$ 1,953.15	$ 2,000	Vendor Quote
Rental truck 4WD (month) - 4 trucks	1	MO	$ -	$ -	$ 2,921.42	$ 2,921.42	$ 2,921	RSM 01 54 33.40 7200
4WD truck fuel (week)	4	WK	$ 448.00	$ -	$ -	$ 448.00	$ 1,792	Engineering Estimate
Rental car (day) - 3 cars	30	day	$ -	$ -	$ 132.79	$ 132.79	$ 3,984	Vendor Quote
Rental car fuel (week)	4	WK	$ 229.09	$ -	$ -	$ 229.09	$ 916	Engineering Estimate
Submersible Pump (Month)	1	MO	$ -	$ -	$ 219.11	$ 219.11	$ 219	RSM 01 54 33.40 4700
Truck Scales (Month)	1	MO	$ -	$ -	$ 221.32	$ 221.32	$ 221	Engineering Estimate
Voluntary Alternative Housing	1	MO	$ -	$ -	$ 12,500.00	$ 12,500.00	$ 12,500	Engineering Estimate
Security - Night Watchman - 1	432	HR	$ -	$ 13.50	$ -	$ 13.50	$ 5,832	Engineering Estimate
						C1a Subtotal	*$ 34,800*	per MO

* Job length is estimated for one construction period with working days based on estimated production rates and crew sizes of critical path components.
[1] 1 @ $1,000/month MultiRAE Plus 11.7 eV and 1 @ $765/month SKC Particulate Monitor (Field Environmental Instruments published quote) plus shipping.

Derived Cost C1b - Plans and Submittals

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Construction Operations Plan, QC Plan, Safety Plan, other non-design submittals	1	LS	$ -	$ -	$ -	$ 150,000	$ 150,000	Engineering Estimate
						C1b Subtotal	*$ 150,000*	Lump Sum

[2] Costs to produce planning documents only; the cost for obtaining permits and/or waivers, and set up institutional controls, is added as in indirect capital cost.

Derived Cost C1c - Mobilization/Demobilization

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Mobe/Demobe of Trailers/Storage Boxes	4	EA	$ 230.36	$ -	$ -	$ 230.36	$ 921	RSM 01 52 13.20 0890
Temporary Electric Connect/Disconnect	1	EA	$ 825.61	$ 1,577.82	$ -	$ 2,403.43	$ 2,403	Engineering Estimate
Large Equipment Mobilization/Demobilization	8	EA	$ -	$ 1,100.00	$ 950.00	$ 2,050.00	$ 16,400	RSM 01 54 36.50 0100
Small Equipment	10	EA	$ -	$ 200.00	$ 22.69	$ 222.69	$ 2,200	RSM 01 54 36.50 1100
						C1c Subtotal	*$ 21,900*	per Occurrence

Derived Cost C1d - Travel, Lodging and Per Diem

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Travel, air fare	1.5	Trip	$ 350.00	$ 400.00	$ -	$ 750.00	$ 1,125	Engineering Estimate
Lodging and Per Diem [3]	30	DY	$ 129.00	$ -	$ -	$ 129.00	$ 3,870	CONUS rate, Gallup, New Mexico
						C1d Subtotal	*$ 4,995*	EA Person per MO

[3] Estimates assume an out of town crew including foreman, site supervisor, health and safety officer, quality assurance/quality control officer, and clerk.

Table B-16
Derived Capital Costs
Project: Town or Eureka EE/CA
Location: Eureka, Eureka County, Nevada
Base Year:2015
Size of Site: Town Of Eureka

ITEM 2 GENERAL SITE WORK
Derived Cost C2a - Fence Construction/Repair

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Fence Construction / Repair [4]	1	LF	$ 22.52	$ 4.54	$ 1.26	$ 28.31	$ 30	RSM 32 31 13.20 0200
Temporary Fence Construction / Repair [4]	1	LF	$ 2.00	$ 3.75	$ 1.08	$ 6.83	$ 7	
						C2a Subtotal	*$ 30*	per LF

[4] Costs for constructing and/or repairing permanent fencing around Site perimeter.

Derived Cost C2b -Clearing

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Clear and grub light vegetation[5]	1.00	Acre	$ -	$ 421.60	$ 735.89	$ 1,157.49	$ 1,157	RSM 31 131 3.10 0300
Dust control	0.500	DY	$ 400.00	$ 400.00	$ 1,200.00	$ 2,000.00	$ 1,000.00	Previous Site Experience
						C2b Subtotal	*$ 2,200*	per Acre

[5] Costs for clearing existing vegetation from Site.

Derived Cost C2c - Land Surveying

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Land surveying, Mob/Demob (Lump)	1	LS	$ 1,000.00	$ -	$ -	$ 1,000.00	$ 1,000	
Land surveying, field (hr)	32	HR	$ 200.00	$ -	$ -	$ 200.00	$ 6,400	
Land surveying report (lump)	1.000	LS	$ 4,500.00	$ -	$ -	$ 4,500.00	$ 4,500.00	
						C2c Subtotal	*$ 11,900*	per Occurrence

ITEM 3 EARTHWORK
Derived Cost C3a - General Excavation

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Excavate, place in stockpile (no util's.) (CY)	1	CY	$ -	$ 1.42	$ 4.30	$ 5.72	$ 5.72	RSM 31 23 16.46 5400
Dust Control	0.002	DY	$ 400.00	$ 400.00	$ 1,200.00	$ 2,000.00	$ 4.26	Previous Site Experience
Load stockpiles to trucks (CY)	1	CY	$ -	$ 1.23	$ 1.30	$ 2.53	$ 2.53	RSM 31 23 16.42 0200+15%
						C3a Subtotal	*$ 13*	per CY

Derived Cost C3b - General Backfill

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Import Free Borrow Soil, includes delivery, 15 cy truck	1.2	CY		$ -	$ -	$ -	$ 2	Vendor Quote
Dust Control	0.002	DY	$ 400.00	$ 400.00	$ 1,200.00	$ 2,000.00	$ 4.26	Previous Site Experience
Place/compact backfill/cover material	1	CY	$ -	$ 0.95	$ 2.00	$ 2.95	$ 4	RSM 31 23 23.17 0020+31 23 23.23 5600
						C3b Subtotal	*$ 10*	per CY

Derived Cost C3c - Utility Excavation and Backfill

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Util. clearance - air vac. extract. (HR)	0.3	HR	$ 210.00	$ -	$ -	$ 210.00	$ 63	
Excavation factor for utilities, 4' to 6' deep, 3/4 CY excavator	1	CY	$ -	$ 2.87	$ 2.57	$ 5.44	$ 5	RSM 31 23 16.13 0110
Dust Control	0.003	DY	$ 400.00	$ 400.00	$ 1,200.00	$ 2,000.00	$ 6.67	Previous Site Experience
Import Borrow Soil, includes delivery, 15 cy truck	1.0	CY	$ 14.00	$ -	$ -	$ 14.00	$ 14	Vendor Quote
Place/compact backfill/cover material	1	CY	$ -	$ 0.95	$ 2.00	$ 2.95	$ 3	RSM 31 23 23.17 0020+31 23 23.23 5600
						C3c Subtotal	*$ 92*	per CY

Table B-16
Derived Capital Costs
Project: Town or Eureka EE/CA
Location: Eureka, Eureka County, Nevada
Base Year:2015
Size of Site: Town Of Eureka

Derived Cost C3d - On-Site Transportation

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Off-road truck, 22 cy, 10 MPH, 2 mile cycle	1.3	CY	$ -	$ 1.10	$ 1.88	$ 2.98	$ 4	engineer's estimate
Dust Control	0.003	DY	$ 400.00	$ 400.00	$ 600.00	$ 1,400.00	$ 4.24	Previous Site Experience
						C3d Subtotal	*$ 8.00*	per CY

Derived Cost C3e - Site Restoration

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Import Borrow Soil, includes delivery, 15 cy truck	1,049	CY		$ -	$ -	$ -	$ -	Vendor Quote
Place/compact vegetative layer	1,049	CY	$ -	$ 0.95	$ 2.00	$ 2.95	$ 3,092	RSM 31 23 23.17 0020+31 23 23.23 5600
Hydroseeding	1	Acre	$ 1,621.74	$ 671.75	$ 430.91	$ 2,724.41	$ 2,724	RSM 32 92 19.14 5400
						C3e Subtotal	*$ 5,816*	per Acre

Derived Cost C3f - Erosion and Sediment Control

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Silt Fence, Polypropylene, 3' High, Adverse Conditions	210	LF	$ 0.29	$ 0.43	$ 0.12	$ 0.84	$ 177	RSM 31 25 14.16 1250
Hay Bales, Staked	40	LF	$ 10.37	$ 0.43	$ 0.12	$ 10.92	$ 437	RSM 31 25 14.16 1250
Temporary Hydromulching (MSF)	1	Acre	$ 1,621.74	$ 671.75	$ 430.91	$ 2,724.41	$ 2,724	RSM 32 92 19.14 5400
						C3f Subtotal	*$ 3,300*	per Acre-Year

Derived Cost C3g - Geotechnical Field Work and Reporting

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Geotechnical survey field	1	LS	$ 200.00	$ -	$ -	$ 200.00	$ 200	
Geotechnical testing - field obs./tests	40	per test	$ 200.00	$ -	$ -	$ 200.00	$ 8,000	
Geotech. anal. D1557 moist./density	10	per test	$ 140.00	$ -	$ -	$ 140.00	$ 1,400	
Geotech. report - 1	1	LS	$ 1,000.00	$ -	$ -	$ 1,000.00	$ 1,000	
						C3g Subtotal	*$ 10,600*	per Report

Derived Cost C3h - Analytical and Field Monitoring

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Data validation (each)	0.02	EA	$ -	$ 12.78	$ -	$ 12.78	$ 0.26	
Analytical Supplies	1.00	EA	$ -	$ -	$ 0.77	$ 0.77	$ 0.77	Engineering Estimate
Lab - CAM 17 Metals - solid (each)	0.01	EA	$ 95.00	$ -	$ -	$ 95.00	$ 0.95	Est. based on prior experience at Site
Lab - Pb & As particulate sampling- solid (each)	0.02	EA	$ 10.00	$ 100.00	$ -	$ 110.00	$ 2.20	
						C3h Subtotal	*$ 4*	per SY

Derived Cost C3i-Eureka Creek Sloping and Armoring

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Import 12" Rip Rap, single layer material delivered, coverage=20 SF/Ton	1,040	Ton	$ 29.30	$ -	$ -	$ 29.30	$ 30,472.00	
Import Backing 1"-3", delivered, coverage =90 SF/Ton	250	Ton	$ 30.30	$ -	$ -	$ 30.30	$ 7,575.00	
Excavate to lay back side slopes (approx.130 CF/Linear foot of channel for 640 lin. feet) for a total of 3,100 CY of Excavation (General Excavation at $15/CY)	3,100	CY	$ 31.30	$ -	$ -	$ 31.30	$ 97,030.00	See Derived Cost C3a-Earthwork Above
Place rip rap, General Backfill, $3/Ton Unit Rate	1,290	Ton	$ 32.30	$ -	$ -	$ 3.00	$ 3,870.00	Engineers estimate
						C3j Subtotal	$ 138,947	Lump Sum

Table B-16
Derived Capital Costs
Project: Town or Eureka EE/CA
Location: Eureka, Eureka County, Nevada
Base Year:2015
Size of Site: Town Of Eureka

ITEM 4 TRANSPORTATION, DISPOSAL AND COVER OPTION

Derived Cost C4a - Off-Site Disposal of Non-hazardous Residential Soil

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Transportation and Disposal -Non-Hazardous Contaminated wastes	1	Ton	$ 60.00	$ 22.32	$ 23.33	$ 105.65	$ 106	Quote From US Ecology Beatty NV Landfill via Env. Quality Management, USEPA ERRS contractor.
						C4a Subtotal	*$ 106*	per Ton

Derived Cost C4b - Off-Site Disposal of Slag that Fails TCLP (subject to Land Disposal Restrictions, requires crushing to 1" minus, then stabilization).

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Crushing in enclosed negative pressure temporary structure.	1	Ton	$ 1.00	$ 3.60	$ 3.65	$ 8.75	$ 9	Engineer's estimate
Transportation and Disposal - PTW	1	Ton	$ 108.00	$ 22.32	$ 23.53	$ 153.85	$ 154	Quote for tipping fee (material cost) from A. Peterson, US. Ecology, 02/17/15.
						C4b Subtotal	*$ 163*	per Ton

Derived Cost C4d - Transport Material to Local Landfill or Slag Pile.

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Transport Contaminated Material to Local Landfill (16 CY, 3 mi cycle, 25 MPH average)	1	CY	$ -	$ 3.67	$ 3.73	$ 7.40	$ 7.40	Engineers Estimate
Place/compact waste	1	CY	$ -	$ 0.95	$ 2.00	$ 2.95	$ 3	RSM 31 23 23.17 0020+31 23 23.23 5600
						Eureka Landfill Transport and Placement C4d Subtotal	*$ 10*	per CY

Derived Cost C4e - 2-foot Soil Cover

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Import 12" vegetative/rock layer material, delivered		Ton	$ 19.85	$ -	$ -	$ 19.85	$ -	Vendor Quote
Place/compact 12" thick vegetative/rock layer material		SY	$ -	$ 0.95	$ 2.00	$ 2.95	$ -	RSM 31 23 23.17 0020+31 23 23.23 5600
Dust Control	0.001	DY	$ 1,000.00	$ 400.00	$ 1,200.00	$ 2,600.00	$ 2.60	Previous Site Experience
Import soil, 24" thick barrier material delivered	0.7	SY	$ 12.00	$ -	$ -	$ 12.00	$ 8.00	Vendor Quote
Place/compact 24" thick barrier layer material	0.7	SY	$ -	$ 0.95	$ 2.00	$ 2.95	$ 1.97	RSM 31 23 23.17 0020+31 23 23.23 5600
Geotechnical testing - field obs./tests	0.01	per test	$ 200.00	$ -	$ -	$ 200.00	$ 2.00	
Import Borrow Soil, includes delivery, 15 cy truck		CY	$ 14.00	$ -	$ -	$ 14.00	$ -	Vendor Quote
Place/compact vegetative layer	0.00	CY	$ -	$ 0.95	$ 2.00	$ 2.95	$ -	RSM 31 23 23.17 0020+31 23 23.23 5600
Hydroseeding (MSF)	1.0	SY	$ 0.33	$ 0.14	$ 0.09	$ 0.56	$ 0.56	RSM 32 92 19.14 5400
						C4e Subtotal	*$ 15*	per SY

Table B-16
Derived Capital Costs
Project: Town or Eureka EE/CA
Location: Eureka, Eureka County, Nevada
Base Year:2015
Size of Site: Town Of Eureka

Derived Cost C4f - Construction of Bottom Layer liner of Waste Cell at Local Eureka County Landfill

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Clear and grub light vegetation		Acre	$ -	$ 421.60	$ 735.89	$ 1,157.49	$ -	RSM 31 131 3.10 0300
Compact waste cell base	0.3	SY	$ -	$ 0.95	$ 2.00	$ 2.95	$ 0.98	RSM 31 23 23.17 0020+31 23 23.23 5600
Base geotechnical testing - field obs./tests		per test	$ 200.00	$ -	$ -	$ 200.00	$ -	
Dust Control and moisture conditioning	0.001	DY	$ 300.00	$ 400.00	$ 1,200.00	$ 1,900.00	$ 1.90	Previous Site Experience
Bottom Liner Layer: Compacted Native Layer , 80-mil textured HDPE, leachate collection system, 2 layers 8oz/SY Geotextile fabric. Assume no sand needed for bedding.	1.0	SY	$ 26.00	$ 1.07	$ -	$ 27.07	$ 27.07	Engineer's Estimate based on quote from K. Allen-Northwest Linings, 02/17/15.
						C4fSubtotal	*$ 30*	per SY

Derived Cost C4g - Construction of Top Layer Liner Waste Cell at Local Eureka County Landfill

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Top Liner Layer: 2 layers 12oz./SY geotextile, 80-mil textured LLDPE,	1.0	SY	$ 22.00	$ 0.95	$ 2.00	$ 24.95	$ 24.95	Engineer's Estimate based on quote form Northwest Linings
Import 12" vegetative/rock layer material, delivered		Ton	$ 19.85	$ -	$ -	$ 19.85	$ -	Vendor Quote
Place/compact 12" thick vegetative/rock layer material		SY	$ -	$ 0.95	$ 2.00	$ 2.95	$ -	RSM 31 23 23.17 0020+31 23 23.23 5600
Dust Control	0.001	DY	$ 300.00	$ 400.00	$ 1,200.00	$ 1,900.00	$ 1.90	Previous Site Experience
Geotechnical testing - field obs./tests		per test	$ 200.00	$ -	$ -	$ 200.00	$ -	
Hydroseeding (MSF)	1	SY	$ 0.33	$ 0.14	$ 0.09	$ 0.56	$ 1	RSM 32 92 19.14 5400
						C4g Subtotal	*$ 27*	per SY

Derived Cost C4h-Monitoring Well Work plan, Installation, Development, Sampling and Initial Report	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Well Driller-Install 3 wells to 100 feet bgs.	4.0	DY	$ 300.00	$ 2,000.00	$ 3,000.00	$ 5,300.00	$ 21,200.00	Engineer's Estimate
Geologist	4.0	DY	$ 19.85	$ 1,500.00	$ 500.00	$ 2,019.85	$ 8,079.40	Vendor Quote
Analytical	6.0	Sample	$ -	$ 80.00	$ 20.00	$ 100.00	$ 600.00	RSM 31 23 23.17 0020+31 23 23.23 5600
Work Plan and Report preparation	100.000	HRs		$ 125.00		$ 125.00	$ 12,500.00	Previous Site Experience
						C4g Subtotal	*$ 42,379*	per SY

References:
R.S. Means, 2013, Heavy Construction Cost Data 27th Annual Edition (HCCD).
R.S. Means, 2005, Environmental Remediation Cost Data 11th edition (ERCD) updated to 2013 costs

Derived Cost C4i - 1-foot Rock Slope Protection

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Import 12" rock layer material, delivered	0.5	Ton	$ 30.00	$ -	$ -	$ 30.00	$ 15.00	
Place/compact 12" thick rock layer material	0.3	SY	$ -	$ 0.95	$ 2.00	$ 2.95	$ 0.97	RSM 31 23 23.17 0020+31 23 23.23 5600
Dust Control	0.001	DY	$ 400.00	$ 400.00	$ 1,200.00	$ 2,000.00	$ 2.00	Previous Site Experience
Procure and place 8oz per square yard geotextile fabric	0.7	SY	$ 2.00	$ 1.00	$ 0.50	$ 3.50	$ 2.33	Vendor Quote and Engineer's Estimate
Geotechnical testing - field obs./tests	0.005	per test	$ 200.00	$ -	$ -	$ 200.00	$ 1.00	
Import Borrow Soil, includes delivery, 15 cy truck								Vendor Quote
Place/compact vegetative layer	0.00	CY	$ -	$ 0.95	$ 2.00	$ 2.95	$ -	RSM 31 23 23.17 0020+31 23 23.23 5600
Hydroseeding (MSF)								RSM 32 92 19.14 5400
						C4i Subtotal	*$ 21*	per SY

Table B-16
Derived Capital Costs
Project: Town or Eureka EE/CA
Location: Eureka, Eureka County, Nevada
Base Year:2015
Size of Site: Town Of Eureka

Derived Cost C4j- 4-foot Soil Cover

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Import 12" vegetative/rock layer material, delivered		Ton	$ 19.85	$ -	$ -	$ 19.85	$ -	Vendor Quote
Place/compact 12" thick vegetative/rock layer material		SY	$ -	$ 0.95	$ 2.00	$ 2.95	$ -	RSM 31 23 23.17 0020+31 23 23.23 5600
Dust Control	0.001	DY	$ 1,000.00	$ 600.00	$ 1,200.00	$ 2,800.00	$ 2.80	Previous Site Experience
Import soil, 48" thick barrier material delivered	1.3	SY	$ 11.00	$ -	$ -	$ 11.00	$ 14.63	Vendor Quote
Place/compact 48" thick barrier layer material	0.7	SY	$ -	$ 1.50	$ 2.00	$ 3.50	$ 2.34	Previous Site Experience
Geotechnical testing - field obs./tests	0.015	per test	$ 200.00	$ -	$ -	$ 200.00	$ 3.00	
Import Borrow Soil, includes delivery, 15 cy truck		CY	$ 14.00	$ -	$ -	$ 14.00	$ -	Vendor Quote
Place/compact vegetative layer	0.00	CY	$ -	$ 0.95	$ 2.00	$ 2.95	$ -	RSM 31 23 23.17 0020+31 23 23.23 5600
Hydroseeding (MSF)	1.0	SY	$ 0.33	$ 0.14	$ 0.09	$ 0.56	$ 0.56	RSM 32 92 19.14 5400

Table B-17

Derived Operations and Maintenance (O&M) Cost for the Eureka County Landfill

Project: Town of Eureka EECA- Eureka NV

Location: Eureka County, Nevada

ITEM 1 SITE MAINTENANCE

Derived Cost O1a - Cover Inspection and monitoring well sampling

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Field Labor	10	HR	$ -	$ 110.00	$ -	$110	$1,100	Engineer Estimate
MW Analytical, SWPPP BMPs, & Quarterly Report	48	HR	$ -	$ 170.00	$ -	$170	$8,160	Engineer Estimate
Annual Summary Report	16	HR	$ -	$ 170.00	$ -	$170	$2,720	Engineer Estimate
						O1a Subtotal	*$12,000*	per Year

Derived Cost O1b - Fence Maintenance

DESCRIPTION	QTY	UNIT	MTRL	LABOR	EQUIP	UNIT TOTAL	TOTAL	REFERENCE
Fence Inspection	10	HR	$ -	$ 110.00	$ -	$ 110.00	$ 1,100	RSM 32 31 13.20 0200
Fence Repair	250	LF	$ 1.96	$ 0.46	$ -	$ 2.42	$ 604	RSM 32 31 13.20 0200
						O1b Subtotal	*$1,704*	per Year

Table B-18
Markup Factors for Ely, Nevada

Reference: RS Means Heavy Construction Cost Data 2013

The majority of the work will be excavation (as defined by RSMeans) by equipment operators, laborers, and foremen

Labor[1]

Category	Workers Comp %	Fixed Overhead	Home Office Overhead	Profit	Ely, NV Installation Factor	Rad Trained Personnel	Total Factor
Excavation	-0.7%	16.3%	13%	10%	-11.0%		1.2776

Materials[2]

Profit	Ely, NV Materials Factor	Nevada Sales Tax	Total Factor
10%	-0.40%	5%	1.1518

Equipment[3]

Profit	Ely, NV Equipment Factor	Total Factor
10%	0.60%	1.1066

[1] Labor factor is based on the Ely, Nevada city cost index for Site and Infrastructure, Demolition (RSMeans, page 542).
Workers Comp % is based on Nevada rates for Excavation (RSMeans, page 626).
[2] Materials factor is based on the Ely, Nevada city cost index for Site and Infrastructure, Demolition (RSMeans, page 592).
[3] Equipment factor is based on the Ely, Nevada city cost index for Contractor Equipment (RSMeans, page 592).

APPENDIX C
DRAFT INSTITUTIONAL CONTROL PLANNING DOCUMENT

The Nevada Division of Environmental Protection (NDEP) and Eureka County, Nevada (the County) have developed this Institutional Control Planning Document (ICPD) to guide post-removal site control for Operable Units (OUs) located in the Eureka Smelter Site (Site). As discussed in the Engineering Evaluation and Cost Analysis (EE/CA), each OU defines a specific geographic area containing varying levels of arsenic and lead. After completion of proposed EE/CA removal and disposal alternatives (removal actions), these areas could present an unacceptable human health exposure risk in the future, if the removal actions are compromised. This ICPD defines the roles and responsibilities both NDEP and the County will assume to maintain the integrity of the proposed removal actions and an outline of the components that will support long-term management of the proposed removal actions. This document provides a description of the NDEP and County commitment for post-removal site control.

The EE/CA was developed by the U.S. Environmental Protection Agency (EPA), Region 9 to identify and evaluate a range of removal and disposal alternatives for five OUs associated with the Site. The EPA identified the following OUs at the Site:

- OU-1 Residential Properties
- OU-2 Consolidated Slag Piles
- OU-3 Undeveloped Parcels Within or Adjacent to Former Smelter and Mill Sites
- OU-4 Eureka Creek
- OU-5 Contaminated Material Disposal

The EPA, NDEP, and the County have agreed on removal and disposal alternatives for each of the OUs. Operable Units 1 through 4 will be addressed through either some form of impacted material removal and disposal with associated clean backfill placement or in-place capping of impacted material, while OU-5 only includes a disposal option with capping after repository cells are full.

This ICPD primarily focuses on and outlines the long-term management and stewardship activities for the proposed removal actions completed for OU-1 through OU-3, because these areas contain the majority of remaining slag and impacted soil that, if re-exposed, could present unacceptable human health exposure risk. As discussed in the EE/CA, the proposed remediation of properties in the Site does not provide complete removal of contaminated soil and slag. Instead, remediation efforts focus on creating "barriers" (e.g., clean soil, vegetation, and gravel) between lead and arsenic impacted material and people. Therefore, maintaining the integrity of these clean barriers is critical to minimize human exposure to site contaminants. Barriers have also been proposed for OU-4 and OU-5 through bank stabilization and eventual capping, respectively, but these areas of the site are not expected to contain residential or commercial development in the foreseeable future, and the magnitude and extent of arsenic and lead in these areas is better defined.

The County commits to placing environmental covenants on properties it owns within OUs 1 through 3. The County properties include residences, recreational areas that the public can access, former smelter sites containing slag and impacted soil, and open space for potential future development. The County's commitment to place environmental covenants on properties the EPA has performed cleanup and/or has installed a protective barrier will serve as a good example for residents in the community that are considering environmental covenants for their properties.

The NDEP and the County will perform outreach to other property owners within OUs 1 through 3 to request that they voluntarily place environmental covenants on the parcels that: 1) have already received some form of soil removal, disposal and capping support as a result of removal actions completed in 2013 and 2014 by the EPA; and 2) have removal actions taken in the future using EPA funding that will be requested in the winter of 2015.

The final Institutional Control Plan (ICP) will be a locally controlled and maintained plan with an element of enforcement by NDEP designed to ensure the integrity of clean soil and other protective barriers placed over contaminants left in place throughout the Site. The ICP will include one set of activities and controls to guide grading activities, excavation work and other construction activities on all properties where barriers and caps have been installed and describe another set of activities designed to address areas where removal actions were not completed, but may contain elevated concentrations of lead and arsenic based on the property's proximity to source areas (slag piles) and location on concentration trend maps created for the Site. Refer to Table 1 for ICP requirements and resource components available for the different types of properties that will exist in town after removal actions are complete.

The ICP will also describe services and resources for current and future landowners and residents in town, including education and outreach, technical assistance on soil sampling methods and requirements, clean replacement soil for small residential projects and a permanent disposal site for contaminated soils generated Site wide. The final ICP will be re-evaluated for effectiveness and completeness, at a minimum, on five-year intervals and more often, if necessary, based on identified changes that need to occur sooner to address confusion or inconsistencies in the ICP. These evaluations and requests for changes will be completed by the County and NDEP, and then forwarded to the EPA for their review and concurrence.

The following sections of this ICPD have been developed to support the draft EE/CA and can be modified at a later date depending on the final agreed upon removal and disposal alternatives and outcome of the public review and comment process. This ICPD outlines the following components of an Institutional Control Plan that can be fully developed and discussed after funding is secured for additional removal actions proposed for the Site:

1. A discussion of the type of durable notification mechanism that should be attached to the deeds associated with properties receiving removal actions.

2. The type of notification mechanisms NDEP and the County will adopt to monitor potential soil disturbance on different types of property within the Site.

3. Mechanisms and availability of local clean backfill material and a local repository for impacted soil disposal.

4. An outreach and education program that will create a long-term understanding of the removal activities completed at the Site, how to avoid exposure to the remaining impacted material, and the effects this material can have on the residents of Eureka.

5. Compliance reporting and ICP evaluation.

6. Stewardship and enforcement.

Durable Notification Mechanism - Environmental Covenants

Following proposed removal actions, impacted soil and slag material above cleanup standards can be reasonably expected in specific areas of the Site from one to two feet below clean imported backfill or capping material defined as barriers. Natural events or future land uses may include disturbance or excavation of impacted material beyond the depth of these barriers, which would necessitate the need for some form of durable notification mechanism (DNM) attached to the property deed. Although there are several options for DNMs, the overriding DNM principle is that it should be as durable as a deed restriction and as accessible as homeowner association Covenants, Conditions, and Restrictions (CC&Rs). DNMs may include real property deed restrictions (recognized as the strongest DNM), Environmental Covenants, or some other method or combination of methods. The NDEP and the County recommend the DNM take the form of an environmental covenant (EC), which is a voluntary DNM, that if entered into, would require the current property owner to contact NDEP and the County when proposed disturbance of the protective barrier exceeds three cubic yards and/or leaves the soil beyond the depth of the barrier exposed for a period exceeding one (1) month. The EC will also inform future landowners of potential soil conditions below the barrier on their property to help prevent inadvertent contact with buried contaminated soils. The environmental covenant agreements between a property owner, NDEP and the County are governed by the Nevada Uniform Environmental Covenants Act (Nevada Revised Statute – NRS 445D). See Appendix A for an example environmental covenant.

A generic Soil Management Plan (SMP) will also be developed by NDEP and referred to in the EC. The SMP is a description of the steps necessary to ensure the public is not exposed to impacted material beneath the barrier when a planned disturbance is proposed. The SMP will be composed of several components, including how the County and NDEP will be notified if a property owner wants to disturb potentially impacted material, how the soil should be managed and how the barrier needs to be re-established. The purpose of the SMP is to ensure, in perpetuity, protection of public safety and the environment from potential risks associated with exposure to the lead and arsenic beneath the barrier. An acknowledgement from the property owner that they understand and will adhere to the SMP and its specific components will be required by NDEP and the County prior to implementation.

Notification Mechanisms

All property owners engaging in new residential and commercial development or improvement of a property within OUs 1 through 3 that will disturb more than three cubic yards of soil or their protective barrier and/or leaves the soil beyond the depth of the barrier exposed for a period exceeding one (1) month, must notify the County prior to soil disturbance activities. Property owners engaging in the aforementioned activities where a protective barrier is in place and an EC is attached to the property deed must notify NDEP and the County in accordance with the terms of the EC. In addition to the voluntary notifications described above, there are also a number of other notification mechanisms already available that can be utilized to understand when a soil disturbance is proposed within the Site boundaries. These notification mechanisms include, but are not limited to, the following:

1. The County is notified of any new single family home or commercial construction requiring sewer and municipal water utility service. These local notifications will be followed up with written information to the property owner on the requirements for soil disturbance and management of potentially impacted material.

2. In addition to the notification for sewer and municipal water tie-in associated with construction projects, the County also participates in the local "Call before you dig" system. This system will add an additional layer of local notification to inform the County of proposed excavation work. People who plan to dig must use the “Call before you dig" system to locate the utility infrastructure on their property, and if that property falls within the Site, the County receives notification and can work with the owner to determine the best way to manage the potentially impacted material and re-establish on-site barriers, if they exist. This notification system provides the County and the property owner with another opportunity to discuss the requirements of the ICP, helping prevent property owners from inadvertently damaging the barriers on their property and potential exposure to lead and arsenic impacted soil.

3. After the EPA's removal actions are complete, the NDEP Bureau of Water Pollution Control (BWPC) will begin notifying NDEP's Bureau of Corrective Actions (BCA) of potential soil disturbance to parcels greater than or equal to one (1) acre when the property owner submits an application for a General Stormwater Discharge Permit at Construction Sites in accordance with 40 CFR 122.26(b)(14). The BWPC Stormwater Discharge Permit also applies to projects disturbing at least one (1) acre or that will disturb less than one (1) acre, but are part of a larger common plan for development or sale that will ultimately disturb one (1) or more acres.

Backfill Material and Local Repository

The County will make free backfill material available to residents and property owners in the Site for small residential and commercial projects requiring 3 to 50 cubic yards of clean backfill material to replace impacted material taken to the local repository or barrier material in excess of 3 cubic yards disturbed due to landscaping, driveway repair, gardening, fence building, etc. The County will have the discretion to provide clean backfill material in greater quantities than 50 cubic yards, if the reason the additional material is needed supports the overall intention of the ICP. The County will designate a Site Manager to be the point of contact for questions pertaining to the disposal of impacted soil material and obtaining clean soil.

As discussed in the EE/CA, under OU-5 Disposal Alternative 2, a local landfill or repository will be permitted through the State of Nevada and constructed in conformance with the pertinent requirements of the RCRA Subtitle D requirements for landfill design. The actual design of the landfill will occur during a design phase intended to evaluate the most cost-effective and protective type of landfill. Impacted soil material will be disposed of at this off-site, locally constructed landfill at no cost to the resident or property owner.

Outreach and Education

Initial and future outreach and education is an important component of the ICP that will provide current and future residents and property owners with information on the removal actions conducted in the Site and ways to avoid exposure to any remaining material. The following is a list of documents, local resources, and outreach intended to support this component of the ICP.

Fact Sheet: A fact sheet describing the ICP, the removal actions conducted, public health information, and best management practices for disturbing soil material in the Site will be developed and made available to the public through County offices and also sent to title companies, real estate companies, and appraisers that do business in the Site.

Final Map: When the removal actions are complete, EPA will provide the County with a map showing the cleanup status of all parcels within the area encompassed by the removal actions.

The map will be available at County offices and facilities, and will be provided to title companies, realtors and appraisers who work in the Site area. The map will be updated annually, as needed, by the County to reflect changes and new parcel information. The County will also be responsible for distributing the updated map and notifying interested parties of its availability.

School District Registration: Eureka County will work with the school district to develop appropriate informational materials to include with school registration packets that are provided to parents. In Eureka, registration for school begins with pre-kindergarten, and occurs annually, even for returning students. Thus, every parent of school-aged children will be notified or reminded about lead and arsenic conditions in the soil and best management practices to avoid exposure. This outreach and education component is subject to approval by the Eureka County School Board.

Eureka County School Board: The ICP and its components, to the extent possible, will be memorialized in resolutions passed by the Eureka County School Board to ensure that the proposed actions will be part of the permanent record.

Eureka County Commission: The ICP and its components, to the extent possible, will be memorialized in resolutions passed by the Eureka County Commission to ensure that the proposed actions will be part of the permanent record.

Eureka County Planning Commission: The Planning Commission will include an informational flyer in the standard parceling packet.

Eureka County: The County will develop a variety of public information materials as needed to be used by the school district, at community events and as described throughout this outreach and education section. A binder of public information materials, as a reference, will be placed at the Public Works Office, the Clerk's Office, and at the Eureka Library. The County website will also be used to feature the public information materials.

Blood Testing for Children in the Site: The County will ensure that a free basic annual blood test or screening for lead is available at the Eureka Clinic for children ages 0-18. The program will be sustained for five years from the date of removal action completion or discontinued sooner, if services are not requested.

Month of May Cleanup Notice: As part of the May cleanup notice that is provided to Site water customers annually in their water and sewer bill, Public Works will include reminder information about safe practices for disturbing impacted soil material and obtaining clean soil associated with landscaping, driveway repair, gardening, fence building, etc.

Existing Community Public Education Events: Using existing community events is an effective way to make sure information pertaining to the removal actions and components of the ICP are being provided to residents. For example, the Firewise event sponsored by the Department of Natural Resources, is a well-attended springtime venue where information flyers could be provided to the public.

Youth Recreation Activities: Flyers will be generated and provided to the Eureka Little League Baseball and Youth Soccer coordinators for inclusion in the registration materials. The flyer will also be provided to managers of the local pool.

Newspaper Articles: The County will publish an annual notice in the newspaper regarding the removal actions, the public health hazards, potential exposure risks and best management practices to avoid lead and arsenic exposure.

Information Repositories: The Sentinel Museum will be designated to memorialize removal actions in the context of Eureka's history. The Eureka Library will continue to maintain all materials developed to document the removal actions completed and maintain all future education and outreach materials. The County will provide a binder of materials, annually, to update the library's files.

Landfill Information: A flyer with information about the free clean backfill and repository location will be provided to members of the public when they purchase annual or quarterly permits.

Compliance Reporting and ICP Evaluation

The County and NDEP will develop a reporting template that will document specific information pertaining to local stewardship of the ICP. This information will include, but is not limited to, the amount of outreach and education provided during the quarter, the approximate amount of impacted soil disposed at the repository, the approximate amount of backfill material provided to the community, the number of property owners and residents that engaged in the soil management procedures, and individuals that did not comply with the ICP. The County will provide a written report to NDEP on a quarterly basis or another frequency agreed to by NDEP and the County describing all activities and results associated with implementation of the ICP. NDEP will provide a written report to EPA on a semi-annual basis or other frequency agreed to by EPA and NDEP summarizing all activities and results associated with implementation of the ICP, including the reports from the County as an attachment. The components of the ICP and their effectiveness on the protection of the removal actions will be evaluated annually for the first four years post removal and bi-annually thereafter.

Stewardship and Enforcement

Two types of properties will exist in town after the proposed removal actions have been completed; those that received some form of removal and those that did not. Property owners that voluntarily provided the EPA with access to their property to collect soil samples were provided maps explaining the concentrations of lead and arsenic in soil. If the lead and arsenic concentrations in soil exceeded cleanup action levels, then the property owner had the option to accept removal actions on the property. If the soil sample results indicated there was no exposure risk, then removal actions were not warranted. Property owners that did not elect to provide EPA access to their property did not have their property sampled; therefore, the concentrations of lead and arsenic are not well understood. Concentration trend maps have been developed for the Site based on known concentrations of lead and arsenic and this information has been extrapolated onto properties that were not sampled. These maps provide a range of lead and arsenic concentrations distributed throughout town, in addition to identifying the properties that elected to receive cleanup and those that didn't. These maps will be important resources for the County and property owners to understand the distribution of lead and arsenic in town and where properties have not been cleaned up.

Understanding the extent of local soil disturbance activities after removal actions have occurred and how property owners should comply with the ICP will initially be the responsibility of the County. The County will be the point of contact for all soil disturbance activities requiring oversight and support with post removal site control requirements. Properties that have an environmental covenant attached to the deed will also be required to contact NDEP to discuss the amount of soil disturbance proposed and the details of a soil management plan.

The County's local presence in the community and contact through 'Call before you dig" will lend itself to understanding the amount of property grading and larger-scale excavation work that is taking place, even if they don't have direct involvement through sewer and water service connection activities. As discussed in the Durable Notification Mechanism-Environmental Covenant section of this ICPD, a number of properties will have environmental covenants attached to the deed. This is a voluntary option for the property owner; therefore, the County will maintain a list of properties that have an environmental covenant and those that do not to determine the level of stewardship and outreach necessary to minimize exposure to the potentially impacted soil. In the event that unauthorized soil disturbance is being conducted on a property with an EC attached to it, the County will inform the property owner or their agent of the ICP and EC requirements. If the property owner or agent is not willing to comply, the County will contact NDEP to inform them of the activity.

In the event that unauthorized soil disturbance is being conducted without prior involvement from the County on property that did not undergo any removal action or where removal actions were conducted, but an EC is not attached to the deed, the County will investigate the activity and verbally explain to the property owner or authorized agent how to come into compliance with the ICP and utilize the local backfill and repository support. If the property owner or authorized agent is not willing to comply, the County will provide the property owner with written instructions for the terms of compliance. If the property owner fails to comply with these terms within 7 days from the date of the letter, the County will have the discretion to refer the issue in writing to NDEP depending on the size of the disturbance, the area of town where the disturbance was conducted, the exposure risk to the residents and other factor to be determined.

For properties that do not have an EC attached, NDEP will consider this written referral an indication of a release of a regulated substance and at its discretion use its authority under Nevada Administrative Code (NAC) 445A.347 or 445A.3473 for releases that appear to have resulted in contamination and exceed established limits or quantities. In addition, NDEP, at its discretion, will use its authority per NAC 445A.2269 and NAC 445A.227 to require the property owner to provide an evaluation of the release. This request will take the form of a Request for Release/Spill Information Letter (attached as Appendix B) and will require the property owner to provide specific information within 45 days from the date of the letter. For those properties that do have an EC attached, NDEP will use its authority under the aforementioned NACs and at its discretion, the enforcement authority granted in the Uniform Environmental Covenants Act as provided for in NRS 445D.200.

In the event, the property owner does not comply with reasonable requests from NDEP within specific timeframes, NDEP, under the authority of Nevada Revised Statutes (NRS) 445A.445 (1) and 459.824 (1), has the power and duty to administer and enforce the provisions of NRS 445A.300 to 445A.730 and NRS 459.800 to 459.856 inclusive, all rules, regulations and standards promulgated by the State Environmental Commission, and all orders and permits promulgated by the Department. NDEP is also authorized by Nevada Revised Statutes 445A.675, 445A.690 and 459.852 to make findings and issue orders.

The NDEP may impose civil penalties upon any person who violates or contributes to the violation of any provision of NRS 445A.300 to 445A.730, inclusive. The person is liable to NDEP for a civil penalty of not more than $25,000 per day, for each violation. These penalties are in addition to any other penalty provided in NRS 445A.300 to 445A.730, inclusive, and/or NRS 459.800 to 459.856, inclusive.

TABLE 1

Property Types	**ICP Notice Requirements and Resource Components**						
	Contact the County	Contact NDEP	Soil Management Plan	Call Before You Dig	Stormwater Discharge Permit (>1 Acre)[1]	Outreach and Education	Clean Backfill and Respository Access
Residential Properties that Received Voluntary Removal Actions (EC attached)	X	X	X	X	X	X	X
Residential Properties that Received Voluntary Removal Actions (EC ***not*** attached)	X			X	X	X	X
Residential Properties that did not Accept Voluntary Sampling or Removal Actions (Potentially containing Lead > 425 mg/Kg and Arsenic > 234 mg/Kg)	X			X	X	X	X
Removal Actions Completed on Former Smelter and Slag Properties (EC attached)	X	X	X	X	X	X	X
Removal Actions Completed on Former Smelter and Slag Properties (EC ***not*** attached)	X			X	X	X	X

1. Apply for the Stormwater Discharge Permit, if the project will disturb at least one (1) acre or will disturb less than one (1) acre, but is part of a larger common plan for development or sale that will ultimately disturb one (1) or more acres.

APPENDIX A

[The remainder of this page has been intentionally left blank.]

APNs:

After Recording, Return to:

ABC, LLC
123 Circle
Reno, Nevada 89521

The undersigned hereby affirms that this document, including any exhibits, submitted for recording does not contain the social security number of any person or persons. (Per NRS 239B.030)

GRANT OF PERPETUAL ENVIRONMENTAL COVENANT
(Nevada Revised Statutes Chapter 445D)

THIS GRANT OF PERPETUAL ENVIRONMENTAL COVENANT (this "**Covenant**"), is made by ABC, LLC, a Nevada limited liability company ("**Grantor**") in favor of the State of Nevada, acting through its Department of Conservation and Natural Resources, Division of Environmental Protection, ("**Holder**" or **"NDEP"**) and is effective this ___ day of __________, 2015.

R E C I T A L S:

A. Grantor is the owner in fee simple of that certain real property located in XX County, Nevada, more properly described in **Exhibit "A"** attached hereto and incorporated herein by this reference (all of such property, and any portion or parcel thereof, is referenced herein as the "**Property"**);

B. Nevada Revised Statues (NRS) Chapter 445D, titled *Environmental Covenants (Uniform Act)* (hereafter **"the Act"**), sets forth the procedure for executing and recording an environmental covenant to provide notice to the public of activity and use limitations with respect to real property that is the subject of an environmental response project;

C. The Property is subject to an "environmental response project" as that term is defined in NRS 445D.070 and is the subject of enforcement and remedial action pursuant to Title 40 of the Nevada Revised Statutes and the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601, *et. seq*. (commonly known as "**CERCLA**");

D. Specifically, the Property is located within XXX (the "**Site**"), which was impacted as a result of historic mining activities, as more fully described below;

E. Because of the Property's location within the Site, Grantor desires to subject the Property to certain covenants and restrictions in accordance with the Act, which covenants and restrictions shall run with the Property, and any portion thereof or interest therein, and shall bind all parties having any right, title, or interest in or to the Property in perpetuity; and

F. The Holder is an agency of the State of Nevada and is qualified to hold and enforce this Covenant pursuant to NRS 445D.120(1).

NOW, THEREFORE, pursuant to the provisions of the Act, Grantor hereby grants, and Holder hereby accepts, this Covenant, with the intent that this Covenant burden the Property in perpetuity and that the Property shall be held, used, and conveyed subject to, and in compliance with, the following provisions:

ENVIRONMENTAL COVENANT

I. Recitals. The foregoing Recitals are true and correct and are incorporated herein by this reference.

II. Grant of Environmental Covenant. Pursuant to the Act, Grantor hereby executes this Covenant as an "environmental covenant" with the intent that this Covenant burden the Property, and bind Grantor and any future record owner and, if any, any other person or entity otherwise legally authorized to make decisions regarding the transfer of the Property or placement of encumbrances on the Property, or any parcel thereof, other than by exercise of eminent domain, (an "**Owner**"), in perpetuity. Grantor grants this Covenant to Holder with the intent that Holder may exercise any or all of the remedies of a "holder" under NRS 445D.200, including, without limitation, the right to file suit to obtain an injunction against actual or threatened violations of this Covenant. Holder hereby accepts its appointment as the "Holder" of this Covenant.

III. Notification of Potential Risks. One of the purposes of this Covenant is to notify the public, including future owners and occupants of the Property, that the Property is located within the Site. Mining activities in the 1800s resulted in the discharge of arsenic and lead, which are now known to be hazardous substances... Residual arsenic and lead have been identified at the Site, as defined above, which includes the Property. Sampling was conducted to determine the potential for arsenic and lead to exist on the Property above screening/action levels. Sampling was confined to the top one (1) foot of soil. The United States Environmental Protection Agency ("**EPA**") has established site-specific health-based exposure limits for arsenic and lead in residential areas within the Site, such as the Property, of XX mg/kg total arsenic in soils and XX mg/kg total lead in soils, respectively. While sampling was not conducted below one (1) foot from the ground surface for the presence of arsenic or lead in excess of regulatory standards for the Site, this Covenant serves as public notice that concentrations of these substances above regulatory action levels may be present at depths below the top one (1) foot of soil. Sample results for each parcel comprising the Property and a detailed general reference document related to the Site are available through the Superfund Branch of NDEP's Bureau of Corrective Actions (the "**BCA**"), and also (as of the date of this Covenant) on NDEP's website.

IV. Activity and Use Limitations on the Property. The soil sampling program to confirm the absence of arsenic and lead contamination has been completed to a depth of one (1) foot below final grade. The one (1) foot of clean soil cover is considered the protective remedy on the Property and must be maintained. Owner therefore shall obtain approval from the BCA to manage soil in accordance with the Soil Management Plan referenced in the Institutional Control Plan prior to removing more than three cubic yards of the clean soil cover to any depth below existing grade and leaving that area exposed for a period exceeding one (1) month. Prior to disturbing any soils at a depth below one (1) foot of the current grade of the Property, including, without limitation, disturbances caused by grading, digging, or related construction activities, Owner shall first notify the BCA. For the purpose of clarity, in no event may Owner disturb any soils at a depth below one (1) foot of the current grade of the Property without first providing written notification to the BCA and obtaining the BCA's written permission to proceed.

V. Modifications to this Covenant. This Covenant runs with the Property and is perpetual in nature unless it is modified or terminated pursuant to this Section V, or pursuant to the provisions of the Act, respectively. Owner may request that Holder and NDEP (if NDEP is no longer the Holder of this Covenant at the time of the request) approve a modification or termination of this Covenant; provided, however, that any such modification or termination shall be made in Holder's and NDEP's (if NDEP is no longer the Holder of this Covenant at the time of the request) sole and absolute discretion. As a condition precedent to any modification of this Covenant, Owner must: (1) provide a written proposal to NDEP detailing the modifications to (or termination of) this Covenant proposed by Owner; (2) submit a soil sampling plan to NDEP for review; and (3) upon NDEP's approval of a soil sampling plan, collect and analyze soil samples and provide the results to NDEP for review. If requested by NDEP, Owner shall provide additional information, including, without limitation, additional soil sampling results, to NDEP for review. If NDEP (and Holder, if NDEP is no longer the Holder of this Covenant) determines, in its sole and absolute discretion, that Owner's proposal will maintain an equal or greater level of protection of human health and the environment, NDEP (and Holder, if NDEP is no longer the Holder of this Covenant) may approve such proposal. Notwithstanding anything to the contrary contained in this Covenant, this Covenant may not be terminated or modified accept through a written instrument signed by NDEP (and Holder, if NDEP is no longer the Holder of this Covenant) and recorded in the Official Records of XX County, Nevada.

VI. Inspections. Subject to providing reasonable prior notice to Owner, Holder shall have the right to enter upon the Property at any reasonable time for the purpose of determining Owner's compliance with this Covenant, and, if necessary, for performing any remediation made necessary by Owner's non-compliance with this Covenant. Notwithstanding the foregoing, nothing in this Covenant shall be deemed to limit or otherwise impair any rights that NDEP may have independent of this Covenant to enter upon and inspect the Property.

VII. Successors and Assigns. The provisions of this Covenant shall be binding upon the successors and assigns of Grantor and Holder, and this Covenant shall constitute a burden upon the Property, and shall bind all persons hereafter acquiring or owning any interest in the Property regardless of however such interest may be obtained. NDEP may assign its interest as Holder of this Covenant to any person, entity, or agency qualified to act as a “holder” pursuant to NRS 445D.120(1); provided, however, that no such assignment shall divest NDEP of its right to enforce this Covenant pursuant to NRS 445D.200, or to amend or terminate this Covenant (or prevent any such amendment or termination) pursuant to NRS 445D.180 or 445D.190, respectively.

VIII. Notice to Lessees, Tenants, and Occupants. Owner shall attach this Covenant as an exhibit to any lease, license, or rental agreement for the Property, and Owner shall inform all temporary occupants of the Property of the restrictions set forth in this Covenant.

IX. Holder Accepts No Liability. Holder is an agency of the State of Nevada; NDEP, acting in its capacity as the Holder of this Covenant, does not accept any liability under NRS 445D.120(3) by accepting the grant of this Covenant.

X. Administrative Record. The administrative record of the environmental response project referenced in this Covenant is located at:

Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Bureau of Corrective Actions
901 South Stewart Street, Suite 4001
Carson City, NV 89701-5249

XI. Notices. Owner acknowledges that Holder may use the address of the Property to provide notices to Owner. Any document or notice that Owner desires to provide, or is required to provide, to Holder shall be sent to:

Nevada Division of Environmental Protection
Bureau of Corrective Actions
901 S. Stewart Street; Suite 4001
Carson City, Nevada 89701-5249

Or to any other address that Holder may in the future direct Owner to send notices to.

IN WITNESS WHEREOF, Grantor hereby burdens the Property with this Grant of Perpetual Environmental Covenant effective as of the date written above.

ABC, LLC

____
Name:
Title:

Holder hereby accepts its appointment as the "Holder" of this Covenant effective this ___ day of ______________________________, 2015.

STATE OF NEVADA;
Acting By and Through Its
NEVADA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION,

____
Name: ______________________________
Title: ______________________________

[notary page follows]

STATE OF NEVADA)
)
County of XX)

This instrument was acknowledged before me on _________________, 2015, by XX of ABC, LLC.

____
(Signature of Notarial Officer)

STATE OF NEVADA)
)
County of __________)

This instrument was acknowledged before me on _________________, 2015, by ________________________ as _____________________ of ________________________.

____
(Signature of Notarial Officer)

Exhibit "A"
Legal Description

All of that certain property located in the County of XX, State of Nevada, more particularly described as follows:

PARCEL 1:

[The remainder of this page has been intentionally left blank.]

APPENDIX B

[The remainder of this page has been intentionally left blank.]

<Date>

<RP>
<Mailing Address>

Subject: **Request For Release/Spill Information**

Facility: *<Release/Spill Address>*

Facility ID: *<Case No.>*
OR
Spill Report No. *<Spill Report No.>*

Dear *<RP>*:

The Nevada Division of Environmental Protection (NDEP) received notification on *<Notification Date>* of a Release/Spill (Release) of contaminants at the above described property. *<2-3 sentence description of release>* Because this Release appears to have resulted in contamination and exceeds limits or quantities established by Nevada Administrative Code (NAC) 445A.347 or 445A.3473, you are required to provide an evaluation of the release per NAC 445A.2269 and NAC 445A.227.

Accordingly, you are required to provide one of the following reports within 45 days from the date of this letter, and no later than *<hard date>*:

(A) For Releases that have only impacted soil (not groundwater or surface water), have been excavated such that all residual soil concentrations of contaminants are less than state action levels listed in NAC 445A.2272, and meet other criteria listed in Attachment A, provide a report that contains all the information listed in Attachment A; or

(B) For all other Releases that do not meet the criteria listed in Attachment A, a report that contains all the information listed in Attachment B.

Should you have trouble meeting this deadline, please contact the undersigned to discuss the need for additional time, as the NDEP is interested in resolving incidents such as this as efficiently and amicably as possible.

This information will be used to ensure that sound decisions are collectively made regarding the Release. Please understand that the release of contaminants can be harmful to human health and the environment and that you may be required per NAC to perform cleanup activities related to the Release.

You should make every effort to determine the source and location of the Release. Additionally, every effort should be made to: isolate, contain and remove the source of the Release; and repair or replace equipment and revise operating, maintenance and inspection procedures necessary to prevent recurrence of this Release.

Community health and safety concerns require that you undertake rapid recovery and remediation efforts. You should make every effort to assess the site and conduct cleanup as quickly as possible. Assessment and cleanup may be conducted concurrently. Quick response minimizes contaminant migration and helps reduce cleanup costs. Please recognize that Petroleum Fund Coverage and related work scope and reimbursement concurrences are managed through separate correspondence if these are applicable to this Release.

NAC 459.9719 requires that consulting services involving response, assessment, or cleanup of a hazardous substance release that are conducted for a fee must be performed under the direction and responsible control of a Nevada Certified Environmental Manager. Information on the NDEP Certification Program can be obtained by contacting Certification Program staff at 775-687-9368 or at the Certification Program website at http://ndep.nv.gov/bca/certhome.htm.

(Optional paragraph.)
If the applicable storage tank is registered with the State of Nevada and enrolled in the State of Nevada Petroleum Fund, you may be eligible for reimbursement of NDEP approved assessment and remediation expenses. Registration is a prerequisite to enrollment in the Petroleum Fund except for certain Heating Oil Tanks. If you have questions regarding the Petroleum Fund application process contact the Petroleum Fund Claims Staff at 775-687-9368 or visit the Petroleum Fund website at http://ndep.nv.gov/bca/fundhome.htm. You are encouraged to contact the Petroleum Fund Staff and your assigned Case Officer to discuss registration and enrollment details. Not all tank systems require registration; however, registration is a prerequisite to enrollment in most situations. Please note, however, that assessment and remediation activities shall not be delayed by applications, approval/disapproval, reimbursement, or any other aspect of the Petroleum Fund process.

If you have any questions or need further assistance, please contact me at *<phone number>* or *<e-mail address>*.

Sincerely,

<*Case Officer*>

Attachments (2)
Attachment A – Information Requirements for Soil Releases Excavated to Below Soil Action Levels
Attachment B – Information Requirements for all other Releases

cc: Supervisor, Remediation and Certification Branch, NDEP Bureau of Corrective Actions
<*CC list for city or county at P:\BCA\Program Administration\LUST CC LISTS*>

P:\BCA\Program Administration\Template Letters\RSpill\a2-5-07 Remediation rspill.doc

ATTACHMENT A
Information Requirements for Soil Releases Excavated to Below Soil Action Levels

Release circumstances and initial abatement actions must meet the following criteria for the information requirements in this Attachment to be applicable:

- Location and type of container from which the Release occurred must be known
- Neither groundwater nor surface water have been impacted by the Release
- All soil with concentrations of hazardous substances or petroleum substances that exceed soil action levels listed in NAC 445A.2272 has been removed
- Confirmation sampling has been performed that verifies the removal of all soil with concentrations of hazardous substances or petroleum substances that exceed soil action levels in NAC 445A.2272
- Removal of soil with concentrations of hazardous substances or petroleum substances that exceed soil action levels in NAC 445A.2272 has not been prevented by permanent structures or impediments, including, but not limited to sidewalks, utilities, building or road foundations, trees

If the Release meets the criteria listed above, you are required to provide the information listed below.

For all Releases that do not meet the criteria listed above, you are required to provide the information listed in Attachment B.

1. Description of the Release of Hazardous or Regulated Substances
   (a) Type of material released, including any available documentation (e.g. Material Safety Data Sheets or test results)
   (b) Estimated quantity of material released and the estimation technique utilized
   (c) Date and time of Release or of the release discovery
   (d) Cause of Release
   (e) A description of measures taken to correct and prevent recurrence of this incident
   (f) Potential for a hazard related to fire, vapor or explosion
   (g) A description of any damage known to the operator to have been caused by the Release
   (h) Description of soil action levels from NAC 445A.2272 applicable to the hazardous substances and/or petroleum substances released and how these soil action levels were established.

2. Description of Site Conditions
   (a) Release Location Information:
      i. Latitude/Longitude in decimal degrees (North American Datum 83)
      ii. Estimated accuracy in feet
      iii. Location determination method used
   (b) Names and correspondence address information for all property owners

and facility owners and operators at the site of the Release

(c) Scaled drawing(s) depicting:

i. Property, current land use and structures

ii. Locations and description of underground utilities within 10 feet of Release boundaries

iii. Release surface area boundaries

3. Sample Results

(a) All available testing results (such as laboratory or field soil and/or groundwater sample analysis) including chain of custody sheets, description of sample collection and preservation methods, analytical test methods used, laboratory result sheets with analytical detection limits, and "confirmation" sample results

(b) Scaled drawing depicting Release surface area boundaries, excavation boundaries, and location and depth of each soil/water sample.

4. Description of investigation or cleanup activities completed, underway, and/or proposed

(a) Names and contact information for contractors and consultants employed and scope of duties and responsibilities

(b) A description of completed abatement, containment, and/or remediation activities conducted to date and disposition of any liquid wastes or contaminated soil (include bills of lading, disposal certificates or manifest documentation), including location of soil removal activities and quantity of soil removed and source of material used for backfill

(c) Extent of Contamination (i.e. lateral and vertical dimensions and volume of impacted soil).

(d) Description of sample collection and preservation procedures, analytical test methods, and sample location and depth for all samples collected to date and proposed

(e) Description of proposed additional characterization and/or remediation activities

(f) Scaled drawing depicting (can be included on Drawing(s) associated with 2.(c) above):

i. Surface area boundaries of Release incident

ii. Locations of initial abatement activities

iii. Surface area boundaries and depths of soil removal.

ATTACHMENT B
Information Requirements for all other Releases

For all Releases that do not meet the criteria listed in Attachment A, you are required to provide the following information.

1. Description of the Release of Hazardous or Regulated Substances
   - (a) Type of material released, including any available documentation (e.g. Material Safety Data Sheets or test results)
   - (b) Estimated quantity of material released and the estimation technique utilized
   - (c) Date and time of Release or of the release discovery
   - (d) Cause of Release
   - (e) A description of measures taken to correct and prevent recurrence of this incident
   - (f) Potential for a hazard related to fire, vapor or explosion
   - (g) A description of any damage known to the operator to have been caused by the Release

2. Description of Site Conditions and Surrounding Areas
   - (b) Township, Range and Section
   - (c) Spill Location information:
     - i. Latitude/Longitude in decimal degrees (NAD 83)
     - ii. Estimated accuracy in feet
     - iii. Location determination method used
   - (d) Depth to groundwater and how estimated
   - (e) Soil classification (e.g. ASTM D 2487-00 Standard Practice for Classification of Soil for Engineering Purposes) of impacted, underlying, and surrounding soils
   - (f) Annual precipitation
   - (g) Description and identification and location of any threatened, endangered, or sensitive plant or animal species in the area which may have been or has the potential to be impacted by the Release, if warranted. The Nevada Natural Heritage Program can be contacted at 775-684-2900 to determine locations of recorded threatened, endangered, or sensitive species
   - (h) Names and correspondence address information for all property owners and facility owners and operators at the site of the Release
   - (i) Names and correspondence address information for all adjacent property owners and location of their property in relation to Release location
   - (j) Scaled drawing(s) depicting:
     - i. Property, adjacent properties, and current land uses
     - ii. Locations and description of underground utilities
     - iii. Drainage features and structures
     - iv. Roadways and right-of-ways
     - v. Release surface area boundaries
     - vi. Locations of structures or other impediments to subsurface

investigation or cleanup

vii. Municipal, domestic, and irrigation supply wells within 1 mile of Release location.

3. Sample Results
   (a) All available testing results (such as laboratory or field soil and/or groundwater sample analysis) including chain of custody sheets, description of sample collection and preservation methods, analytical test methods used, laboratory result sheets with analytical detection limits, and "confirmation" sample results
   (b) Scaled drawing depicting Release surface area boundaries, excavation boundaries, and location and depth of each soil/water sample.

4. For non-residential properties, if the specific Release source (location and/or container) and timing of the Release cannot be identified, then you must evaluate past chemical use on the property by submitting a Phase 1 Environmental Site Assessment conducted by a Certified Environmental Manager, or by other method(s) approved by the Division, conducted in accordance with accepted industry standards.

5. Description of investigation or cleanup activities completed, underway, and/or proposed
   (a) Names and contact information for contractors and consultants employed and scope of duties and responsibilities
   (b) A description of completed abatement, containment, and/or remediation activities conducted to date and disposition of any liquid wastes or contaminated soil (include bills of lading, disposal certificates or manifest documentation) including location of soil removal activities and quantity of soil removed and source of material used for backfill
   (c) Extent of Contamination (i.e. lateral and vertical dimensions and volume of impacted soil). If the full extent is not yet defined, then provide details and a schedule for future characterization activities.
   (d) Description of sample collection and preservation procedures, analytical test methods, and sample location and depth for all samples collected to date and proposed
   (e) Description of proposed additional characterization and/or remediation activities
   (f) Scaled drawing depicting (can be included on Drawing(s) associated with 2.(i) above):
      i. Surface area boundaries of Release incident
      ii. Locations of abatement and remediation activities
      iii. Future/proposed sampling locations.

APPENDIX D
SUMMARY ANALYSES OF REMOVAL AND DISPOSAL ALTERNATIVES

EE/CA Alternatives Analysis for Operable Unit (OU)-1 - Residential Properties
Eureka, Eureka County, Nevada

OU-1	Alternative	Alternative Description	Alternative Implementability	Alternative Effectiveness	[1]Alternative Cost
Residential Properties	**Removal Alternative 1**: No Action	Under the No Action Alternative, no additional sampling or Removal Actions would occur and no additional direct costs would be incurred. Residential properties may continue to act as ongoing sources of contamination via exposure routes that include fugitive dust, contaminated surface runoff, and direct contact pathways.	**Low** This alternative is easily implemented because there is no construction or permitting considerations. EPA guidance requires that the reliability of the technology be considered along with feasibility. Since No Further Action is inherently an unreliable remedy, this criterion is rated low.	**Low** The alternative does not provide protection to human or environmental exposure, nor is it considered a permanent remedy as it does not reduce the toxicity, volume, or mobility of hazardous waste at the Site, and is considered low for achieving the RAOs.	**$0**
	Removal Alternative 2: Soil Removal and Capping at Tier I and Tier II Properties; ICs; and Outreach and Education Programs	Currently there is ~42,500 CY of contaminated soil located on 170 Tier I and Tier II residential properties (known and projected) in OU-1. Under Alternative 2 contaminated soil from both Tier I and Tier II properties would generally be excavated to a depth of 1 foot, and covered with 1 foot of imported clean fill material(s). This alternative would require the excavation and disposal of ~42,500 CY of contaminated soil, and would require ~42,500 CY of imported clean fill material(s) at Tier I and Tier II properties. No soil removal would occur on Tier III properties; however, ICs, and outreach and education programs would be implemented.	**High** This alternative rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and capping activities. Residential sites are also readily accessible. Site-specific ICs and outreach and education programs are readily achievable based on former EPA experience at comparable sites throughout the western United States.	**Medium** The effectiveness is considered medium for achieving the RAOs. This alternative would significantly minimize potential exposure to contaminated soils at Tier I and Tier II residential properties at the Site. However, lead and arsenic concentrations in some areas at Tier III properties may remain above the EPA's Regional Screening Level for Soil in a residential scenario. Federal and State ARARs would be met for the Site under this alternative.	**$16,650,000**
	Removal Alternative 3: Soil Removal and Capping at Tier I, Tier II, and Tier III Properties; ICs; and Outreach and Education Programs	Currently there is ~49,625 CY of contaminated soil located on 227 Tier I, Tier II, and Tier III residential properties (known and projected) in OU-1. Under Alternative 3 contaminated soil from Tier I, Tier II, and Tier III properties would generally be excavated to a depth of 1 foot, and covered with 1 foot of imported clean fill material(s). This alternative would require the excavation and disposal of ~49,625 CY of contaminated soil, and would require ~49,625 CY of imported clean fill material(s) at Tier I, Tier II, and Tier III properties. ICs and outreach and education programs would be implemented.	**High** This alternative rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and capping activities. Residential sites are also readily accessible. Site-specific ICs and outreach and education programs are readily achievable based on former EPA experience at comparable sites throughout the western United States.	**High** The effectiveness is considered high for achieving the RAOs. This alternative would significantly minimize potential exposure to contaminated soils at Tier I, Tier II, and Tier III residential properties at the Site. Since contaminated soils would be excavated and removed from all three property Tiers, potential exposure reductions to those accessing the Site would be permanent. Federal and State ARARs would be met for the Site under this alternative.	**$17,910,000**

Notes:

[1] - Total alternative present worth not including disposal costs
ARAR - applicable or relevant and appropriate requirement
EPA - Environmental Protection Agency
CY - cubic yards
ICs - Institutional Controls
RAO - removal action objective

EE/CA Alternatives Analysis for Operable Unit (OU)-2 - Slag Piles
Eureka, Eureka County, Nevada

OU-2	Alternative	Alternative Description	Alternative Implementability	Alternative Effectiveness	[1]Alternative Cost
Slag Piles	**Removal Alternative 1**: No Action	Under the No Action alternative, no additional work or Removal Actions would occur, the slag piles would remain at their current locations, and no additional direct costs would be incurred. Slag materials would continue to act as ongoing sources of contamination via exposure routes that include fugitive dust, contaminated surface runoff, and direct contact pathways. Portions of the RCS and ECS slag piles would continue to erode into the drainages adjacent to them.	**Low** This alternative is easily implemented because there is no construction or permitting considerations. EPA guidance requires that the reliability of the technology be considered along with feasibility. Since No Action is inherently an unreliable remedy, this criterion is rated low.	**Low** This alternative does not provide protection to human or environmental exposure, nor is it considered a permanent remedy as it does not reduce the toxicity, volume, or mobility of hazardous waste at the Site, and is considered low for achieving the RAOs.	**$0**
	Removal Alternative 2: Removal of Slag Piles to an Existing Landfill; and ICs	Under this alternative, slag materials and an assumed 2-foot-thick layer of underlying contaminated soils would be excavated and hauled to a hazardous waste landfill (U.S. Ecology Beatty, Nevada). Based on sampling data, leachate concentrations emanating from the slag waste exceed the federal limits for hazardous waste, and therefore subject to LDRs. Slag would need to be crushed to a particle size of 1 inch or less prior to stabilization. Clean fill material would be imported as necessary to establish grades and surface water drainage patterns. It is assumed creek bank stabilization and repair would be necessary in Eureka Creek adjacent to the RCS and ECS slag piles.	**Low** This alternative rates lowest in technical and administrative implementability. It is technically feasible and would utilize conventional techniques, materials, and labor for the excavation and associated activities. However, it would require compliance with Section 404 of the Clean Water Act (Section 404 permit) and, since the nearest existing permitted landfills are located over four hours drive, this alternative would necessitate an expenditure of approximately 52,251 hours of vehicle run time for disposal. The additional noise and potential for dust from crushing, loading, and hauling, and the high volume of heavy equipment and truck traffic also make this more difficult to implement than any of the OU-2 alternatives.	**High** This alternative is considered high for achieving the RAOs. Since contaminated slag and soils would be excavated and removed, potential exposure reductions to those accessing the Site would be permanent. In addition, long term ICs would increase awareness of any residual contaminants and minimize potential exposure to potentially contaminated soils at the Site. Federal and State ARARs would be met for the Site under this alternative.	**$3,230,000 (Note: The total cost of this alternative including offsite disposal at an existing landfill is $22,431,000)**
	Removal Alternative 3: Consolidation, Grading, and In-Place Capping of Slag Piles with a 2-Foot Soil Cover; and ICs	Under this alternative, no excavation or disposal of contaminated material would occur. Slag at each slag pile site would be used to fill in existing holes, voids, and low-lying areas, and to reduce slope angles in available areas where existing slopes are steeper than approximately 3:1 H:V ratio. It was assumed that ~10,000 total CY of slag would need to be moved or re-graded within the Site. After grading and placement of imported wastes, slag pile(s) would be capped in-place using either 2 feet of compacted fill material, or a HDPE geomembrane liner and 2 feet of compacted fill material. Clean fill would be imported as necessary to establish grades and surface water drainage patterns. Portions of the drainages adjacent to each slag pile would need to be excavated and armored to reduce erosion. Depending on exact capping methods, the final elevation of each slag pile would be expected to increase between 1-5 feet.	**Medium** This alternative rates medium in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the consolidation, grading, capping and associated activities. The slag pile sites are also readily accessible. Consolidation, grading, and capping would be scheduled and performed in a manner that ensures worker and public safety. Site-specific ICs are readily available based on former EPA experience at comparable sites throughout the western United States. Because of the necessary bank stabilization work within Eureka Creek, it would require a Section 404 permit.	**High** This alternative is considered high for achieving the RAOs. It significantly minimizes potential for exposure to highly contaminated slag materials at the Site. It would provide control of slag concentrations, reduce or eliminate their mobility, and reduce risks to human health and the environment at the Site to levels within the acceptable risk range. This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site. Federal and State ARARs would be met for the Site under this alternative.	**$3,550,000**
	Removal Alternative 4: Limited Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with a 2-Foot Soil Cover; and ICs	Under this alternative, limited contaminated wastes (~5,000 CY) would be used to fill in existing holes, voids, and low-lying areas, and to reduce slope angles where existing slopes are steeper than approximately 3:1 H:V at the RCS and/or ECS slag pile(s). Following disposal of waste onto the utilized slag pile(s), the slag pile(s) would be graded such that the slopes are less than 3:1 H:V. ~5,000 CY of contaminated waste generated from the Site would be imported to the RCS and/or ECS slag pile(s). After grading and placement of imported wastes, slag pile(s) would be capped in-place using either 2 feet of compacted fill material, or a HDPE geomembrane liner and 2 feet of compacted fill material. Clean fill would be imported as necessary to establish grades and surface water drainage patterns. Portions of the drainages adjacent to each slag pile would need to be excavated and armored to reduce erosion. Depending on exact capping methods, the final elevation of each slag pile would be expected to increase between 1-5 feet.	**Medium** This alternative rates medium in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the consolidation, grading, capping and associated activities. The slag pile sites are also readily accessible. Consolidation, grading, and capping would be scheduled and performed in a manner that ensures worker and public safety. Site-specific ICs are readily available based on former EPA experience at comparable sites throughout the western United States. However, because of the necessary bank stabilization work within Eureka Creek, it would require a Section 404 permit and a limited amount of trucking of waste within the Town of Eureka.	**High** This alternative is considered high for achieving the RAOs. It significantly minimizes potential for exposure to highly contaminated slag materials and contaminated soils at the site. It would provide control of slag and soil concentrations, mobility, and a reduction in risk to human health and the environment at the Site. This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site. Federal and State ARARs would be met for the Site under this alternative.	**$3,640,000**
	Removal Alternative 5: Maximized Use of RCS and/or ECS Slag Piles as Consolidated Waste Repositories; Grading and In-Place Capping of Slag Piles with a 2-Foot Soil Cover; and ICs	Under this alternative, ~26,000 CY of contaminated wastes generated from OU 1, OU-2, OU-3, and/or OU-4 would be used to fill in existing holes, voids, and low-lying areas, and to reduce slope angles where existing slopes are steeper than approximately 3:1 H:V at the RCS and/or ECS slag pile(s). After grading and placement of imported wastes, slag pile(s) would be capped in-place using either 2 feet of compacted clean fill material, or a HDPE geomembrane liner and two feet of compacted clean fill material. Clean fill would be imported as necessary to establish grades and surface water drainage patterns. Portions of the drainages adjacent to each slag pile would need to be excavated and armored to reduce erosion. Depending on exact capping methods, the final elevation of each slag pile would be expected to increase between 5-15 feet.	**Low** This alternative rates low for technical and administrative implementability since it requires the greatest degree of engineering and design work due to the necessary construction of retaining walls and similar engineered structural components that other alternatives don't require. Although these structures are conventional in nature and the slag pile sites are generally accessible, the retaining walls would require additional structural engineering design work. Additionally, because of the necessary bank stabilization work within Eureka Creek, it would also require a Section 404 permit with the associated hydraulic and hydrologic modeling. It also includes the greatest amount of trucking of waste within the Town of Eureka of any of the OU-2 alternatives.	**High** The effectiveness of this alternative is considered high for achieving the RAOs. It significantly minimizes potential for exposure to highly contaminated slag materials and contaminated soils at the Site. This alternative would provide control of slag and soil concentrations, mobility, and a reduction in risk to human health and the environment at the Site. This alternative is expected to effectively mitigate the long-term effects on potential human and ecological receptors at the Site. Federal and State ARARs would be met for the Site under this alternative.	**$5,450,000**

Notes:

[1] - Total alternative present worth not including disposal costs
ARAR - applicable or relevant and appropriate requirement
CY - cubic yards
ECS - Eureka Consolidated Smelter
EPA - Environmental Protection Agency
H:V - horizontal to vertical
HDPE - high density polyethylene
ICs - Institutional Controls
LDRs - land disposal restrictions
RAO - removal action objective
RCS - Richmond Company Smelter

EE/CA Alternatives Analysis for Operable Unit (OU)-3 - Undeveloped Parcels within or adjacent to Former Smelter and Mill Sites
Eureka, Eureka County, Nevada

OU-3	Alternative	Alternative Description	Alternative Implementability	Alternative Effectiveness	Alternative Cost
Undeveloped Parcels within or adjacent to Former Smelter and Mill Sites	Removal Alternative 1: No Action	Under the No Action Alternative, no additional sampling or Removal Actions would occur, and no additional direct costs would be incurred. These areas may continue to act as ongoing sources of contamination via exposure routes that include fugitive dust, contaminated surface runoff, and direct contact pathways.	**Low** This alternative is easily implemented because there is no construction or permitting considerations. EPA guidance requires that the reliability of the technology be considered along with feasibility. Since No Action is inherently an unreliable remedy, this criterion is rated low.	**Low** This alternative does not provide protection to human or environmental exposure, nor is it considered a permanent remedy as it does not reduce the toxicity, volume, or mobility of hazardous waste at the Site, and is considered low for achieving the RAOs.	**$0**
	Removal Alternative 2: Smelter and Mill Footprint Area, 1-Foot Soil Excavation and Removal with a 1-Foot Soil and/or Rock Cover on >10% slopes; and ICs	Under this alternative, excavation of 1 foot of contaminated soil would occur at undeveloped parcels identified within OU-3. Relatively level areas of the excavated area would be covered with 1 foot of clean fill material, then graded and restored. Excavated areas with greater than 10% slopes would be covered with clean, imported 4- to 8-inch rock. ICs would be implemented.	**Low** OU-3 Removal Alternative 2 rates low in technical and administrative implementability. Although it is technically feasible and would utilize conventional equipment, materials, or labor for the excavation and associated activities, the steep slopes in the identified OU-3 land parcels are not readily accessible to conventional excavation equipment. Because many of the parcels are steeply sloped, excavation and backfill in those areas can be difficult. Whenever possible, excavation would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety, however, because of the steep slopes some material may have to be handled twice. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors. Because it requires the excavation and subsequent backfill with rock on these steep slopes, and not just rock slope protection, it rates lower in implementability in comparison to OU-3 alternative 3.	**High** The effectiveness of OU-3 Removal Alternative 2 is considered high for achieving the RAOs. This alternative would significantly minimize potential exposure to contaminated soils at the Site. This alternative would provide control of soil concentrations, mobility, and a reduction in risk to human health and the environment at the Site. Potential limited exposures during excavation, transport, and at the final disposal site would be managed through engineering controls and PPE. However, the workers, residents, and community members would be subject to increased, dust levels, traffic, and emissions from passenger vehicles, heavy equipment, and trucks. Therefore, a medium level of short-term protection of human health and the environment would be achieved under this alternative. Federal and State ARARs would be met for the Site under this alternative.	**$4,639,000**
	Removal Alternative 3: Smelter and Mill Footprint Area Slope Capping with 1 Foot of Rock (Rock Slope Protection); Limited 1-Foot Soil Excavation and Removal with a 1-Foot Soil Cap n Residential Areas; and ICs	Under this alternative, contaminated areas identified in OU-3 would be primarily capped with 1 foot of 4- to 8-inch rock. Limited excavation (to 1 foot) would occur at planned residential areas, which would then be covered with 1 foot of clean fill at relatively flat areas and 1 foot of clean, imported 4- to 8-inch rock in areas where slopes exceed 10%. ICs would be implemented.	**Medium** This alternative rates medium in technical and administrative implementability since it is technically feasible and would utilize conventional equipment, materials, or labor for the excavation and associated activities. The identified OU-3 land parcels are also somewhat accessible; however, some parcels are steeply sloped and clearing, grubbing and placing rock on steep slopes can be technically difficult. To the extent possible, excavation and capping activities would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. However, as with OU-3 Alternative 2, some rock slope protection materials may need to be handled twice. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to sensitive receptors.	**High** The effectiveness of OU-3 Removal Alternative 3 is considered high for achieving the RAOs. This alternative would minimize potential exposure to contaminated soils at the Site. This alternative would provide control of soil concentrations, mobility, and a reduction in risk to human health and the environment at the Site. Potential limited exposures during excavation, transport, and at the final disposal site would be managed through engineering controls. Therefore, a medium level of short-term protection of human health and the environment would be achieved under this alternative. Federal and State ARARs would be met for the Site under this alternative.	**$3,853,000**

Notes:

[1] - Total alternative present worth not including disposal costs
ARAR - applicable or relevant and appropriate requirement
EPA - Environmental Protection Agency
ICs - Institutional Controls
RAO - removal action objective

EE/CA Alternatives Analysis for Operable Unit (OU)-4 - Eureka Creek
Eureka, Eureka County, Nevada

OU-4	Removal Alternative	Alternative Description	Alternative Implementability	Alternative Effectiveness	Alternative Cost
Eureka Creek	**Removal Alternative 1**: No Action	Under the No Action alternative no direct actions would be performed to remediate contaminated sediments in Eureka Creek, and no additional direct costs would be incurred.	**Low** This alternative is easily implemented because there is no construction or permitting considerations. EPA guidance requires that the reliability of the technology be considered along with feasibility. Since No Action is inherently an unreliable remedy, this criterion is rated low.	**Medium** Concentrations of contaminants of concern would be allowed to attenuate naturally via the flushing action of periodic flood events. If enough of the suspected sources of contaminated sediment are addressed (i.e., contaminated areas within the Town of Eureka, including the slag piles), concentrations are expected to decrease. However, the decrease may be slow, on the order of decades or centuries as contamination migrates downstream and is presumably mixed with clean sediments entering the system.	**$0**
	Removal Alternative 2: Limited Excavation of Soil/Sediments and Rip Rap Armoring	Under this alternative, impacted portions of Eureka Creek not already covered with rip rap would be excavated to a depth of 1.5 feet below the existing channel bottom. Rock rip rap would be placed back in the channel in an 18-inch thick layer. Sediment and erosion control measures will be installed as necessary. These may include the construction of sediment basins, diversion channels, and other significant features required to prevent damage to work in progress or the environment.	**Medium** OU-4 Removal Alternative 2 rates medium in technical and administrative implementability. It is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities and the identified impacted areas of Eureka Creek are readily accessible. However, it would likely require procurement of and compliance with a Section 404 Permit, including the associated hydraulic and hydrologic modeling, and post-removal monitoring. Additionally, work might be limited to dry weather periods, and or require the construction of cofferdams and pumping systems that bypass surface water around construction areas.	**Medium** The effectiveness of OU-4 Removal Alternative 2 is considered medium for achieving the RAOs. This alternative would minimize potential exposure to contaminated sediment at the Site and provide a significant reduction in further migration of contaminated sediment downstream. This alternative would also provide significant reduction in the potential release of lead and arsenic from sediment to surface water. Potential limited exposures during excavation, transport, and at the final disposal site would be managed through engineering controls. However, some contaminants may remain in sediments deeper than 1.5 feet below the channel bottom, and these sediment may become partially re-distributed during large flood events. Federal and State ARARs would be met.	**$3,160,000**
	Removal Alternative 3: Excavation of Soil/Sediments and Rip Rap Armoring	Under this alternative, impacted portions of Eureka Creek not already covered with rip rap would be excavated to a depth of 2.5 feet below the existing channel bottom. One foot of clean imported fill would be placed and compacted into the channel bed. After the fill is placed, 18 inches of rock rip rap would be installed in the channel. Sediment and erosion control measures will be installed as necessary. These may include the construction of sediment basins, diversion channels, and other significant features required to prevent damage to work in progress or the environment.	**Medium** OU-4 Removal Alternative 3 rates medium in technical and administrative implementability. It is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities and the identified impacted areas of Eureka Creek are readily accessible. However, it would likely require procurement of and compliance with a Section 404 Permit, including the associated hydraulic and hydrologic modeling, and post-removal monitoring. Additionally, work might be limited to dry weather periods, and or require the construction of cofferdams and pumping systems that bypass surface water around construction areas.	**Medium** The effectiveness of OU-4 Removal Alternative 3 is considered medium for achieving the RAOs. This alternative would minimize potential exposure to contaminated sediment at the site and provide a significant reduction in further migration of contaminated sediment downstream. This alternative would also provide significant reduction in the potential release of lead and arsenic from sediment to surface water. Potential limited exposures during excavation, transport, and at the final disposal site would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative. However, very large magnitude flood events may still mobilize any residual contaminants. Federal and State ARARs would be met.	**$3,720,000**

Notes:

[1] - Total alternative present worth not including disposal costs
ARAR - applicable or relevant and appropriate requirement
EPA - Environmental Protection Agency
RAO - removal action objective

EE/CA Alternatives Analysis for Operable Unit (OU)-5 - Contaminated Material Disposal
Eureka, Eureka County, Nevada

OU-5	Disposal Alternative	Alternative Description	Alternative Implementability	Alternative Effectiveness	Alternative Cost
Contaminated Material Disposal	**Disposal Alternative 1**: Offsite Disposal at an Existing Landfill	Under this alternative the existing 10,600 CY of stockpiled soil at the site, and up to the additional estimated 126,900 CY, of assumed non-hazardous contaminated material generated from the site would be loaded and transported to an existing landfill facility permitted to receive contaminated material (RCRA Subtitle D). The estimated 61,900 CY of assumed hazardous contaminated material (slag) generated from the site would be loaded and transported to an existing landfill facility permitted to receive hazardous waste (RCRA Subtitle C).	**High** OU-5 Removal Alternative 1 rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities. The excavation and stockpile sites are also readily accessible. Hauling would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Since none of the existing permitted landfills are located within 4 hours drive time of the Site, this alternative also has the highest amount of trucking and heavy equipment use in total vehicle hours. It is estimated that disposal actions for Alternative 1 would be completed in four construction seasons (April through November), because all actions would not be performed concurrently due to the large volume of material (approximately 11,500 truckloads of soil and slag). The long drive to the disposal facility, would also contribute to the need for multiple construction seasons. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to the general public and sensitive receptors. Profiling and manifesting of the material would be done in coordination with the transporters and off-site disposal facility.	**High** The effectiveness of OU-5 Removal Alternative 1 is considered high for achieving the RAOs. This alternative would permanently eliminate the potential exposure to contaminated materials at the Site. However, because of the large number of hours of equipment operation, and the associated potentially noisy crushing and stabilization operations required, which also potentially exposes workers to more respirable forms of lead and arsenic than any other alternative, Alternative 1 is ranked the lowest of the 4 OU-5 alternatives in short term effectiveness. Potential limited exposures during excavation, transport, crushing, stabilization, and at the final disposal site would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative. Federal and State ARARs would be met.	**$37,190,000**
	Disposal Alternative 2: Offsite Disposal at a Locally Constructed Landfill and Disposal of Slag Piles at an Existing Landfill	Under this alternative a total of between 16,000 CY to 137,500 CY of contaminated soil would be disposed of at an offsite, locally constructed landfill. The local landfill would be permitted through the State of Nevada and constructed in conformance with the pertinent requirements of the RCRA Subtitle D requirements for landfill design. The actual design of the landfill would occur during a design phase intended to evaluate the most cost-effective and protective type of landfill. The 61,900 CY of slag would be crushed, stabilized, and disposed of at an existing off-site landfill permitted to receive hazardous waste (RCRA Subtitle C).	**High** OU-5 Removal Alternative 1 rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities. The excavation and stockpile sites are also readily accessible. Hauling would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. This alternative involves the second greatest amount of material transfer, stockpile, development/management, loading of bulk hazardous material carriers, truck traffic, fossil fuel use and site restoration activities (Alternative 1 is the greatest). Since no existing landfills are within 4 hours drive, and due to the amount of material being transported, this alternative would also take four construction seasons to implement. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to the general public and sensitive receptors. Profiling and manifesting of the material would be done in coordination with the transporters and off-site disposal facility.	**High** The effectiveness of OU-5 Removal Alternative 2 is considered high for achieving the RAOs. This alternative would permanently eliminate the potential exposure to contaminated materials at the Site. Potential limited exposures during excavation, transport, crushing, stabilization, and at the final disposal sites would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative. Federal and state ARARs would be met.	**$26,295,000**
	Disposal Alternative 3A: Disposal of Maximum Estimated Soil from OU-1, OU-3, and OU-4 at a Locally Constructed Landfill	Under this alternative up to 114,500 CY of contaminated soil would be transported and disposed at a repository constructed within the Town of Eureka. A rock-lined channel would be constructed around the downslope edges of the repository to stabilize the toe and prevent erosion and a 4-foot-thick, permanent, vegetated cap would be installed. This alternative does not include the slag and soil beneath the slag. It is assumed that Eureka County would provide land for the repository (landfill) and that the County would operate and maintain the landfill after it was constructed.	**High** OU-5 Removal Alternative 3A rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities. The excavation and stockpile sites are also readily accessible. Hauling would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. Contaminated material would be transported shorter distances than in Alternatives 1 and 2 resulting in less fossil fuel usage; however, the amount of material included in the removal action would still necessitate field activities occurring over four construction seasons. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to the general public and sensitive receptors. Profiling and manifesting of the material would be done in coordination with the transporters.	**High** The effectiveness of OU-5 Removal Alternative 3A is considered high for achieving the RAOs. This alternative would permanently eliminate the potential exposure to contaminated materials at the Site. Potential limited exposures during excavation, transport, crushing, stabilization, and at the final disposal sites would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative. Federal and State ARARs would be met.	**$5,905,000**
	Disposal Alternative 3B: Disposal of Residential Soil at a Locally Constructed Landfill	Under this alternative, only contaminated soil from OU-1 would be transported and disposed at a locally constructed landfill (repository). Consistent with Alternative 3A, the landfill design would include a rock-lined channel around the downslope edges of the repository to stabilize the toe and prevent erosion and a 4-foot-thick, permanent, vegetated cap would be installed. It is assumed that Eureka County would provide land for the repository (landfill) and that the County would operate and maintain the landfill after it was constructed. Estimated volume of contaminated soil to be placed in the landfill is 60,200 CY.	**High** OU-5 Removal Alternative 3A rates high in technical and administrative implementability since it is technically feasible and would utilize conventional techniques, materials, or labor for the excavation and associated activities. The excavation and stockpile sites are also readily accessible. Hauling would be scheduled and performed in a manner that maximizes direct loading and ensures worker and public safety. This alternative involves the least amount of material transfer, stockpile development/management, loading of bulk hazardous material carriers, truck traffic, fossil fuel use, and site restoration activities of any of the disposal alternatives. However, not all field activities can happen concurrently so implementation is estimated to take three to four construction seasons. Engineering controls for fugitive dust and site monitoring would be utilized to control potential exposures to the general public and sensitive receptors. Profiling and manifesting of the material would be done in coordination with the transporters.	**High** The effectiveness of OU-5 Removal Alternative 3B is considered high for achieving the RAOs. This alternative would permanently eliminate the potential exposure to contaminated materials at the Site. Potential limited exposures during excavation, transport, crushing, stabilization, and at the final disposal sites would be managed through engineering controls. Therefore, a high level of protection of human health and the environment would be achieved under this alternative. Federal and State ARARs would be met.	**$3,351,000**

Notes:
ARAR - applicable or relevant and appropriate requirement
CY - cubic yards
RAO - removal action objective
RCRA - Resource Concervation and Recovery Act

APPENDIX E
RESPONSES TO PUBLIC COMMENTS

Response to Comments
Engineering Evaluation/Cost Analysis Report
Eureka, Eureka County, Nevada

Specific Comments

Comments received in writing at the community meeting:

1.1 Comment Received: If the plan goes through, it might be good to include a section of a [Eureka] High School Ag class committed to this topic (history, management, etc.)

Agency Response: *EPA is always open to engaging with the community when and where there is interest. The EPA site team will reach out to the Eureka High School principal and school superintendent to make them aware of this particular comment and express willingness to engage with the high school if there is continued interest.*

1.2 Comment Received: There is no hard evidence of lead caused health problems in Eureka. Cost of cleanup is too great for possible benefit to Eureka. Moving slag piles could cause dust hazard where none now exists. I vote no on "EPA" cleanup".

Agency Response: *The laws and regulations which determine whether EPA should take action to address hazardous substances do not require that EPA document the presence of health problems.*

As per 40 CFR 300.415(b) of the National Contingency Plan.

> ***(1)** At any release, regardless of whether the site is included on the National Priorities List (NPL), where the lead agency makes the determination, based on the factors in paragraph (b)(2) of this section, that there is a threat to public health or welfare of the United States or the environment, the lead agency may take any appropriate removal action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or the threat of release.*
> ***(2)** The following factors shall be considered in determining the appropriateness of a removal action pursuant to this section:*
> ***(i)** Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;*
> ***(ii)** Actual or potential contamination of drinking water supplies or sensitive ecosystems;*
> ***(iii)** Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;*
> ***(iv)** High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;*
> ***(v)** Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;*
> ***(vi)** Threat of fire or explosion;*
> ***(vii)** The availability of other appropriate federal or state response mechanisms to respond to the release; and*
> ***(viii)** Other situations or factors that may pose threats to public health or welfare of the United States or the environment.*

As per paragraph (i), EPA has documented actual or potential exposure to nearby human populations; and as per paragraph (iv), EPA has documented high levels high levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate. As such, EPA believes the performance of a removal action is necessary and warranted.

1.3 Comment Received: Take care of the situation ASAP.

Agency Response: *Thank you for your comment. EPA is working to move forward with the project as quickly as possible while still maintaining a high standard of work product/performance and collaborating with the Town of Eureka and Nevada Department of Environmental Protection.*

1.4 Comment Received: Any work implemented on privately held OU-3 land parcels would consider a private owners' access to roads and highways. To the extent practical, during the design phase of the project, EPA would develop approaches that would minimize disruption to roadway accessibility during the construction phase and to preserve private owner right-of-ways in the finished product.

Agency Response: *EPA will continue to work closely with private land owners during all phases of the project and consider the private owners' access to roads and highways. EPA will work to develop approaches that will minimize disruption for private owners and maintain owner right-of-ways during construction and at the completion of the project.*

1.5 Comment Received: Any work implemented on OU-3 land parcels would consider a private owners' existing use and planned development of these properties. To the extent practical, during the design phase of the project, EPA would develop approaches that would minimize disruption to the private owners' use and development during the construction phase and to accommodate both in the finished product.

Agency Response: *See agency response above (1.4). EPA will strive to develop approaches that will minimize disruptions to private owners' use and development during the construction phase and will look to accommodate both in the completion of the project. EPA appreciates the continued cooperation of private land owners during this project.*

The next several comments were taken from a longer public comment letter. EPA has extracted comments from the letter where the commenter requested a response or where was is appropriate to do so and has answered each individually. The full public comment letter is included for reference following this Response to Comments document.

1.6 Comment Received: The decision not to use local labor and contractors in the soil removal, replacement and lawnscaping [sic] and soil sampling should have been done by local contractors and laborers.

Agency Response: *The previous EPA work conducted in Eureka, including soil removal and replacement and restoration of existing landscaping was conducted as part of two separate Time Critical Removal Actions. As the commenter points out, the personnel working under these removal actions were not from Eureka, although several of the workers were from the Reno/Sparks area. Since all of the work conducted to date by EPA in Eureka was conducted as part of Time Critical Removal Actions, each action had a very short window to plan and conduct the work. In order to perform this work in an expedited fashion, EPA relied on an existing federal contract. This is the typical process employed by the EPA Emergency Response program, as our projects are all of an* *urgent nature and are widely scattered across the United States. Identifying local labor and contractors and/or entering into site specific contracts is typically not a viable option for EPA in order to complete the work quickly and effectively.*

In the work conducted to date, EPA did make numerous attempts to procure goods and services locally, when such resources were available. However, given the remote location of Eureka, there is a limited supply of goods and services available. EPA did purchase backfill material locally. This material was delivered to EPA using trucks and drivers also supplied locally.

When conducting work in the future and when longer planning horizons exist, EPA is interested in using local Eureka contractors and labor, when available. In conducting any work, EPA is required to follow the Federal Acquisition Regulations (FAR). The FAR includes many specific requirements regarding contracting procedures and requirements for contractors. In addition, any contractors or individuals working for EPA in Eureka will likely have to meet certain requirements including OSHA requirements specified in 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response Standard (HAZWOPER).

1.7 Comment Received: There was no clear explanation, only guesses, as to how the $5,000,000 was spent.

Agency Response: *As the commenter points out, EPA has obligated or spent approximately $5,050,000 in responding to lead and arsenic contamination in the Town of Eureka. A summary of these expenditures is provided below:*

<u>EPA Emergency and Rapid Response Services (ERRS) Contract cost:</u> *$4,400,000. This money has been obligated for past and future cleanup work to be conducted by the EPA ERRS cleanup contractor. To date, approximately $3,240,000 has been spent on cleanup work associated with two removal actions in Eureka. This work included cleanup of forty-three (43) residential properties and a small portion of the Eureka Elementary School property. In addition to the actual cleanup work, this expenditure included the performance of historical and cultural surveys of all properties where work was performed, topographic surveys of several properties, engineering evaluations of the slag piles and of several potential disposal locations, lodging and per diem for personnel, contractor overhead, etc. EPA estimates that the average cost to clean up the forty-three residential properties to date is in the range of $75,000 to $80,000 per property. Understandably, there is some cost variability associated with each property. The cleanup cost per property is substantial due a number of factors, including: lack of availability of goods and services locally, high cost of mobilization of goods and services to Eureka from distant sources, necessity of performing cultural and historical surveys, applicability of Davis Bacon labor rates, etc.*

The costs incurred to date do not include disposal. Cost estimates provided in the EE/CA relating to disposal include construction of the repository and disposal of approximately 60,000 cubic yards of soil, not just the 10,000 cubic yards of soil generated to date.

The remaining funding balance under the ERRS contract has been set aside for cleanup work to be conducted in the spring and summer of 2016. The priorities for this funding include construction of a permanent repository of excavated soil, cleanup of additional residential properties, and covering of contaminated soil present at the site of the former Atlas and Hoosac Smelters. The repository would store the approximately 10,000 cubic yards of contaminated soil already excavated and approximately 50,000 cubic yards of soil to be excavated in the future.

Superfund Technical Assistance and Response Team (START) Contract: *$600,000. EPA has spent or obligated this funding for technical assistance under the START contract. This funding was used for soil sampling of residential properties prior to cleanup, soil confirmation sampling and air sampling during cleanup activities, preparation of the EE/CA and other areas of technical support.*

United States Coast Guard Pacific Strike Team: *$50,000. This has been spent or obligated for support provided by the USCG Pacific Strike Team. This work included assisting EPA with health and safety, contractor oversight and other technical support.*

The $5,050,000 cost figure does not include costs for EPA personnel time, EPA travel cost or indirect costs.

1.8 Comment Received: The slag piles at the north and south end of town have a proposed budget of $3,500,000 to remediate. The EPA's [sic] has made up claim that it is a hazard to the town. Science has triumphed here that the slag is vitric – glass. Although the lead and arsenic values are high, these lead-arsenic values are encapsulated in the vitric glass…Please explain in your response about the vitric dust, the amount generated and the potential for a person to breathe in the vitric dust."

Agency Response: *EPA believes that migration of fine-grained material containing high levels of lead and arsenic away from the slag piles presents an exposure pathway[1] of concern. Parcels located adjacent to the slag piles have extremely high levels of lead and arsenic, which suggests that migration of fine grained material from the slag piles has occurred. During geotechnical testing of the slag material, a high percentage of material from the light colored slag (which makes up much of the northern slag pile) passed through the 100 and 200 mesh sieves, indicating a fine grain material. Geotechnical testing of other parts of the slag material did indicate that much of the slag is more consistent with a soil and therefore less fine in grain.*

EPA does believe that the slag piles present less exposure risk as compared to the exposure risk associated with the contaminated residential parcels and the highly contaminated undeveloped parcels located on the former mill and smelter sites. As such, EPA would prioritize work so that contaminated residential parcels and the contaminated undeveloped parcels are addressed first.

1. *An exposure pathway refers to the way a person can come into contact with a hazardous substance. There are three basic exposure pathways: inhalation, ingestion, or direct contact.*

1.9 Comment Received: If the EPA was really interested in evaluating a hazard of the slag piles, they would drill monitoring wells below the dump...TCLP[1] values do not suggest leaching of the lead and arsenic values from the slag piles.

Agency Response: *To date, the removal actions EPA has performed have focused on removal of contaminated soil from residential properties. This is considered to be the most direct exposure pathway to site related contaminants. The EE/CA also evaluated cleanup of high levels of contamination at undeveloped parcels and at the slag piles. As the commenter points out, one potential exposure pathway associated with the slag piles is migration of contaminants in the slag piles to groundwater. It is EPA's understanding that the aquifer beneath the Town of Eureka is not currently used as a drinking water source, nor is it planned to be used as a drinking water source in the future. Eureka County provides drinking water to Eureka residents from wells located outside of town. These wells are not impacted by contamination associated with the slag piles. Drinking water is also obtained from a series of springs that are not impacted by contamination associated with the* *slag piles. The cap design evaluated in the EE/CA included an option for a high density polyethylene (HDPE) geomembrane liner that would limit the migration of contaminants to groundwater.*

EPA finds the statement that TCLP values do not suggest leaching of lead and arsenic from the slag piles to be incorrect. In 2014, EPA evaluated samples from the north slag pile and the south slag pile for extractable metals using the TCLP and SPLP[2] procedures. In addition, these samples were also evaluated for extractable metals using the Meteoric Water Mobility Procedure (MWMP) test. For all three extractable metals analyses performed, slag material samples exceeded the benchmarks for lead and arsenic, suggesting leaching.

1. *TCLP is the Toxicity Characteristic Leaching Procedure, designed to determine the mobility or leaching of a waste through a substance. In this instance, the tests determined the mobility of lead and arsenic through the slag piles.*
2. *Synthetic Precipitation Leaching Procedure (SPLP) determines the mobility of inorganic phases present in waste materials in acid conditions caused by acidic rain.*

1.10 Comment Received: Local contractors in Eureka would be more responsible due to local peer pressure to do a good job and be much less expensive.

Agency Response: *As stated previously (see 1.6), there are very limited local contracting resources in Eureka. EPA is interested in using local resources in the future when possible, as long as appropriately trained and equipped resources exist. These resources also have to meet federal contracting regulations.*

EPA has been very satisfied with the quality of work performed by EPA contractors working in Eureka, and we have received extensive positive feedback from numerous people within Eureka regarding the quality of work and professionalism displayed by the EPA contractors.

1.11 Comment Received: The question of proposing Eureka as a superfund site was obfuscated as best as possibility. [sic] The only clear answer was that the group present in Eureka had the authority to spend only $6,000,000. After that any work would be done under superfund status. Is this to be the fate of Eureka and please specify EPA's policy beyond your knowledge by asking superiors as high as you have to go.

Agency Response: *All EPA work conducted to date in Eureka has been performed by the EPA Emergency Response program, which is part of the Superfund program. The approximately $5,050,000 spent or obligated so far by the Emergency Response Program has come from the Superfund budget. The EPA Emergency response program has a statutory limit of $6,000,000 which can be spent on a time critical removal action. One possibility for sites that exceed $6,000,000 is to place the site on the National Priorities List (NPL). Sites placed on the NPL become eligible for larger sources of funding. EPA recognizes that concerns exist in Eureka and in the State of Nevada with regard to NPL listing. In part due to these concerns, EPA has searched for alternatives to NPL listing. Due to the threat posed by exposure to lead and arsenic soil contamination, the fact that most of the site characterization is already complete and that the remedy is straightforward, EPA views the performance of the EE/CA and an associated non-time critical removal action as the most desirable path forward for future work in Eureka. However, the availability of funding for this path forward is less certain than the availability of funding associated with NPL listing.*

1.12 Comment Received: The State of Nevada EPA has a program called instructional education. Why is such a misleading, non-descript name that explains nothing of its activities but has so invasive of a name. Please explain their purpose in this EPA action as the State of Nevada was invited by EPA to this meeting.

Agency Response: *We believe the commenter is referring to the Institutional Control Program which would be implemented by Eureka County and the Nevada Division of Environmental Protection (NDEP). The purpose of the institutional control program is described in Appendix C of the EE/CA. For more information regarding the Institutional Control Program, contact Jeff Collins at NDEP: jrcollins@ndep.nv.gov or (775) 687-9381.*

1.13 Comment Received: With approximately 15 to 20 participants at the public meeting, there were no copies of the EECA available to those attending the meeting.

Agency Response: *Two hard copies of the EE/CA were available at the public meeting and one of these hard copies was given to the commenter at the meeting. Prior to the meeting, electronic copies of the EE/CA were made available online. Hard copies of the EEC/A were, and continue to be, available at multiple locations in Eureka, including the Eureka County Public Works Office, the Eureka County Library and the Eureka County Senior Center. The availability of both the electronic and h;'osfkg;oih;li hjard copy versions of the EE/CA was announced via a fact sheet that was mailed to all Eureka residents, via the newspaper and via County Commissioner's web page. Additional hard copies of the EE/CA were and continue to be available upon request, but no such requests were received by EPA.*

1.14 Comment Received: It [the EE/CA] …leaves out the implications of the slag, which again, is a recognized disposal method of hazardous waste.

Agency Response: *EPA believes that the slag material is not chemically or physically stable and is not resistant to erosion and migration over the long-term. As the commenter points out, vitrification of waste material is a recognized treatment technology. The following information regarding vitrification is excerpted from the EPA contaminated site cleanup information web page:*

> *VITRIFICATION uses an electric current to melt contaminated soil at elevated temperatures (1,600 to 2,000ºC or 2,900 to 3,650ºF). Upon cooling, the vitrification product is a chemically stable, leach-resistant, glass and crystalline material similar to obsidian or basalt rock. The high temperature component of the process destroys or removes organic materials. Radionuclides and heavy metals are retained within the vitrified product. Vitrification can be conducted in situ or ex situ.*

A goal of the vitrification process typically includes reaching certain end points, including that the product is chemically stable and leach resistant, such that the treated material meets various performance standards, including TCLP standards. As stated previously, the slag material does not meet TCLP standards.

1.15 Comment Received: Figures 10 & 11 respectively, are the intentional distortions of the data collected…The Archimedes Pit, which is at least 1000 feet deep and has no soil cover and you have represented lead value from 401 to 5000 ppm. On the arsenic map, the values range from 61 to 600 ppm. There is no explanation of the color scheme but it is totally biased on the number of data points that are totally inadequate for what you want to present on the maps. A reasonable search radius should have been established, more data points or cropping the limits of the extent of the anomalous values. The use of the closest 12 data points in not industry standard and this needs to be redone to eliminate the bias by a competent person knowledgeable in the proper standard, these maps are an unprofessional presentation. Will this be done?

Agency Response: *EPA acknowledges that lead and arsenic isoconcentrations drawn on the outer portions of Figures 10 and 11 (generally outside the Eureka town site boundaries) are based on a limited number of data points. In these areas, EPA data points are limited either because we were not given permission to sample on certain properties or because the topography made it difficult to collect samples. Since the project area of the EE/CA is considered to be any areas within the Town of Eureka that have lead or arsenic concentrations that exceed three times background levels, and since the number of data points outside of the town site boundaries are limited, EPA has revised these figures so that the contour lines do not extend beyond the town site boundaries.*

1.16 Comment Received: There is no indication that the soil survey distinguishes between natural soil lead and arsenic values from the lead and arsenic values from the smelter plumes. Would you put all of these anomalous areas into a superfund site even though the values are natural and you soil plan maps are totally biased and sample density inadequate for any scientific plotting. Please explain the rational for using the computer generation of these two plots when a more rational program would not include the Archimedes Pit and waste dumps would not be in these erroneously anomalous zones as well an on sited noting previously excavated home sites. These bias and misrepresented conclusions mentioned above reflects the unscientific and unprofessional representations that affect the credibility of the entire report with similar erroneous conclusions too numerous to mention.

Agency Response: *The commenter states that the soil survey does not distinguish between naturally occurring levels of lead and arsenic and lead and arsenic values resulting from smelter plumes. This statement is incorrect. As is discussed in Section 3.3.1 (Background Soil) of the EE/CA, EPA conducted extensive background soil sampling.*

"Statistical evaluation all 66 background soil samples indicated a median lead concentration of 37 mg/kg and a mean lead concentration of 47 mg/kg. Calculation of the estimated average concentration based upon an Upper Confidence Limit (UCL) evaluation indicated a 95% probability that the ***true mean concentration for lead in Eureka background soil is not greater than 50 mg/kg.*** *Similarly, a median arsenic concentration of 13 mg/kg, and a mean arsenic concentration of 16.75 mg/kg were calculated. The calculation of the estimated average concentration based upon UCL evaluation indicated a 95% probability that* ***the true mean concentration for arsenic in Eureka background soil is not greater than 20 mg/kg.****"*

Based on this information, EPA concluded that areas containing lead and arsenic soil levels more than three times background (greater than 150 mg/kg lead and greater than 60 mg/kg arsenic) as depicted in these figures, have been impacted by smelting operations.

[redacted]

December 7, 2015

EPA:

This letter is in response to questions that arose during a meeting with residence of Eureka, Nevada and the EPA on November 2, 2015.

The decision not to use local labor and contractors in the soil removal, replacement & lawnscaping & soil sampling should have been done by local contractors and laborers. A long excuse laden explanation was given by Bret Moxley, Tom Dunkelman & Sarah Cafasso as to why not but no effort was made to attempt to incorporate locals. Of the $5,000,000 spent so far, the only benefit to the town of Eureka was the monies spent at motels and restaurants. As an EPA response to the above, please including plans to incorporate more/all work to be done with in the town by the EPA by local contractors and laborers. It can be done so limit your excuses please. Also, there was no clear explanation, only guesses, as to how the $5,000,000 was spent. According to your guesses $4,250,000 was spent to clean 47 private parcels. This amounts to $90,425/residential lot, not including the $750,000 for administrative costs which added, boost it to $106,383/parcel. Additionally, $1,000,000 is sought to permanently store the contaminated soils near the local elementary school. The complete cost for the 47 parcels will comes to $127,660. Is there a question as to padding bills or kickbacks in the most corrupt Federal administration in US history? Please respond.

The slag piles at the north and south end of town have a proposed $3,500,000 budget to "remediate". The EPA's has made up claim that it is a hazard to the town. Science has triumphed here that the slag is vitric – glass. Although the lead and arsenic values are high, these lead-arsenic values are encapsulated in the vitric glass. Vitrification is a government approved method of hazard waste storage to then be covered. This method for remediation of the Eureka slag pile is thinking too much inside the box. It is already vitrified!! These slag piles are also on the National Historical Site. The EPA is attempting to destroy these sites only to perpetuate their jobs. Please tell us where you will go after you leave Eureka hopefull still standing? The remediation to the destruction of the slag piles is to put a plastic replica of the original topography of the slag piles at the site and expect it to visually justify their destruction? Kid from Eureka have played on the dumps with no ill health effects – remember it is glass. This playihg on the dumps is as dangerous as drinking out of leaded glasses – none. Civil War soldiers wounded with lead bullets that were not removed, live long lives with no lead issues. The claim by Bret Moxley that weathering – freeze & thaw – breaks down the slag. This only results in smaller pieces of vitric slag with the lead and arsenic still encapsulated. The topic of dust was brought up. Please explain in your response about vitiric dust, the amount generated and the potential for a person to breath in the 'vitric dust'. There are no "Great Vitric Dust Storms" in Eureka.

If the EPA was really interested in evaluating a hazard of the slag piles , they would drill monitoring wells below the dump but as of yet, not done as insisted upon by mining companies in similar situations. Water quality down stream is of no interest to the EPA so stated by Moxley. TCLP values do not suggest leaching of the lead and arsenic values from the slag piles. If the vitric material does not leach, how can it be hazardous to walking over it from the imagined dust threat? Please explain your reasons for the direr necessity for capping the dumps other than your continued employment?

The EPA requires that, for example, mining companies to mitigate wet land use. What would be the compensation from the EPA to the town of Eureka for mitigation of the destruction of its National Historical site? $1,000,000 would be a good start as this action is initiated by the EPA or does the EPA have a double standard? If it is a double standard, please explain or the EPA has no responsibility for false science its purpose is for perpetuating their jobs.

Dayton, Nevada is presently the only superfund site in Nevada. It's importance in this discussion is that individual homes built recently in the area of 1880 tailings from the Comstock with mercury have been mitigated. But, it has been determined that the Carson River that is within the superfund site contaminated with mercury should not be disturbed as cleanup would do more damage related to mercury contamination than leaving well enough alone. This decision could easily be applied to the Eureka slag piles at a saving of $3,500,000 of taxpayers monies – do nothing. The savings from this false science could be sent to the town of Eureka through the EPA.

In another example of EPA planning and construction is the Gold King Mine in southwestern Colorado. Approved designs for remediation by a non-local contractor and the EPA resulted in an environmental disaster, see the attached article. Local persons with knowledge of the drainage situation knew it would be a failure but were ignored. Local contractors in Eureka would be more responsible due to local peer pressure to do a good job and be much less expensive would have been a good example of the above. Although the EPA claimed responsibility for the heavy metal contamination, it was only a shoulder shrug to excuse it and no one responsible for the disaster was fired as this designer of the disaster was someone interested in perpetuating his job with an expensive water treatment plant and a perpetual employee to run it than turning it over to knowledgeable, local people.

Another EPA fiasco is Eureka, Utah where the EPA created a near ghost town with the threat and intimidation of creating a superfund site. The tourist economy was destroyed and home values were destroyed along with displaced families.

The question of proposing Eureka as a superfund site was obfuscated as best as possibility. The only clear answer was that the group present in Eureka had the authority to spend only $6,000,000. After that any work would be done under a superfund status. Is this to be the fate of Eureka and please specify EPA's policy beyond your knowledge by asking superiors as high as you have to go?

The State of Nevada EPA has a program called instructional education. Why such a misleading, non-descript name that explains nothing of its activities but has so invasive of a name? Please explain their purpose in this EPA action as the State of Nevada was invited by the EPA to this meeting. This also applies to the EPA EE/CC report available at the town library. It is 129 pages of text with 3 pages with approximately 90 acronyms and 4 appendices that the public is to understand? With the approximately 15 to 20 participants at the meeting, there were no copies of this report available to those attending – rude and unprofessional. Why is this document not readily available to the concerned public if it so definitive in its conclusion? Please explain. It is a very slanted/biased too and leaves out the implications of the vitrification of the slag, which again, is a recognized EPA disposal method of hazardous waste. Please explain the EPA's agenda for Eureka, Nevada.

Another major incorrect application of the computer are the drafted lead and arsenic soil concentration maps, Figures 10 & 11 respectively, are the intentional distortions of the data collected. This application demonstrates an agenda with this intentional misuse of scientific data, garbage in garbage out, to distort the data. The Archimedes Pit which is at least 1000 feet deep and has no soil cover and you have represented lead value from 401 to 5000 ppm. On the arsenic map, the values range from 61 to 600 ppm. There is an explanation of the method used to generate the color scheme but it is totally biased as the number of data points are totally inadequate for what you want to present on the maps. A reasonable search radius should have been established, more data points or cropping the limits of the extent of the anomalous values. The use of the closest 12 data points is not industry standard and this needs to be redone to eliminated the bias by a competent person knowledgeable to the proper standard, these maps are an unprofessional presentation. Will this be done? There is no indication that the soil survey distinguishes between natural soil lead and arsenic values from the lead and arsenic values from the smelter plumes. Would you put all of these anomalous areas into a superfund site even though the values are natural and you soil plan maps are totally biased and sample density inadequate for any scientific plotting? Please explain the rational for using the computer generation of these two plots when a more rational program would not include the Archimedes Pit and waste dumps would not be in these erroneously anomalous zones as well an on sited noting previously excavated home sites. Did the contractor visit the site and if so why are these such glearing errors?

These bias and misrepresented conclusions mentioned above reflects the unscientific and unprofessional representations that affect the credibility of the entire report with similar erroneous conclusions too numerous to mention.

Sincerely & Merry Christmas,

[redacted]