DRAFT
REMOVAL ACTION WORK PLAN
for
The Grove at Nevada City
Nevada City, California

Prepared on behalf of:
Nevada City Tech Center
12555 Dunbar Road
Glen Ellen, California 95442

Prepared by:
Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

Project No. 3006B-03
May 12, 2015

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Project No. 3006B-03
May 12, 2015

California Environmental Protection Agency
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826

Attention: Randy Adams, C.E.G., Senior Engineering Geologist

Reference: ***The Grove at Nevada City***
Docket No. HAS 14/15-010
Portion of APN 05-190-053-000
105-191 Providence Mine Road
Nevada City, California 95959

Subject: ***Removal Action Work Plan***

Dear Mr. Adams:

On behalf of Nevada City Tech Center, Holdrege & Kull (H&K) prepared this Removal Action Work Plan (RAW) to describe procedures for on-site management of mine waste (naturally mineralized soil and rock) for The Grove at Nevada City, a proposed residential development associated with the Nevada City Tech Center. The approximately 15-acre site is located west of the existing Tech Center campus in Nevada City, California. This RAW summarizes the results of site investigation and risk assessment, evaluates remedial alternatives, and presents the recommended remedial action, which includes consolidation of mine waste in open space on-site under a land use covenant.

If you have any questions regarding this RAW or the site in general, please contact the undersigned.

Sincerely,

HOLDREGE & KULL

Bryan Botsford
Staff Geologist

Jason W. Muir, C.E. 60167
Principal Engineer

copies: 2 to DTSC /Attn: Mr. Randy Adams
1 to Nevada City Tech Center /Attn: Robert Upton
PDF to all recipients via email

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LIST OF ACRONYMS

ABA	Acid Base Accounting
AGP	Acid Generation Potential
APN	Assessor's Parcel Number
ARAR	Applicable, relevant and appropriate requirements
bgs	below ground surface
BLM	United States Bureau of Land Management
BMP	Best Management Practices
BTV	background threshold value
CalEPA	California Environmental Protection Agency
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response Compensation and Liability Act of 1980 (Superfund)
CFR	Code of Federal Regulations
COPC	constituent of potential concern
COPEC	constituent of potential ecological concern
CQA	construction quality assurance
CTP	California Toxics Rule
DI	Deionized water
DLM	Designated Level Methodology
DMP	Dust Mitigation Plan
DQI	Data Quality Indicators
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
EPC	exposure point concentrations
ESA	ecological screening assessment
FA	Financial Assurance
GIS	Geographic Information System
HHRA	Human Health Risk Assessment
HHSE	Human Health Screening Evaluation
HSC	California Health and Safety Code
HSP	Health and Safety Plan
H&K	Holdrege & Kull
LUC	land use covenant
MDL	method detection limit

LIST OF ACRONYMS (continued)

mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
NCDEH	Nevada County Department of Environmental Health
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NOA	naturally occurring asbestos
NOI	Notice of Intent
NP	Neutralization Potential
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule
OEHHA	CalEPA Office of Environmental Health Hazard Assessment
OMA	operation and maintenance agreement
OSHA	Occupational Safety and Health Administration
PEF	particulate emission factor
PEA	Preliminary Endangerment Assessment
PID	photoionization detector
QAPP	Quality Assurance Project Plan
RACR	Removal Action Completion Report
RAO	remedial action objective
RAW	Removal Action Work Plan
RCRA	Resource Conservation and Recovery Act
RL	laboratory reporting limit
RME	reasonable maximum exposure
RPD	relative percent difference
RSL	Regional Screening Level
RWQCB	California Regional Water Quality Control Board
SARA	Superfund Amendment and Reauthorization Act
SOP	standard operating procedure
SDL	soluble designated level
SSI	Supplemental Site Investigation
SSP	Site Safety Plan
STLC	Soluble Threshold Limit Concentration
SWPPP	Storm Water Pollution Prevention Plan
TCLP	Toxicity Characteristic Leaching Procedure
TMDL	Total Maximum Daily Load

LIST OF ACRONYMS (continued)

TTLC	Total Threshold Limit Concentration
UCL	upper confidence limit
USGS	United States Geological Survey
VCA	Voluntary Cleanup Agreement
VSAP	Verification Sampling and Analysis Plan
WET	Waste Extraction Test
XRF	X-ray fluorescence
µg/dL	micrograms per deciliter
$\mu g/m^3$	micrograms per cubic meter
µg/L	micrograms per liter

EXECUTIVE SUMMARY

Holdrege & Kull (H&K) prepared this Removal Action Work Plan (RAW) pursuant to California Health and Safety Code (HSC) Chapter 6.8, Sections 25323.1 and 25356.1, California Senate Bill 1706, and the National Contingency Plan (NCP). The purpose of this RAW is to describe procedures for conducting remedial activities to address recognized environmental conditions associated with past Site use. The RAW presents remedial action objectives, proposes remedial procedures for the recommended remedial alternatives, and provides a verification soil sampling plan to document that remedial action objectives are achieved.

Site Description

The Grove at Nevada City (the Site) is an approximately 15-acre proposed residential development that comprises a portion of Nevada County Assessor's Parcel Number (APN) 05-190-53. The Site is located east of an existing unnamed road and west of the Tech Center campus in Nevada City, California. A vicinity map and site map are presented as Figure 1, which was prepared by KPFF Consulting Engineers (September 2013).

The Site is currently undeveloped and vacant. Historical hard rock and placer gold mining operations occurred on the Site, as described in Section 2 of this RAW.

Development plans prepared by KPFF Consulting Engineers (September 2013) indicate that the proposed development will include approximately 59 residential units, paved roads, and underground utilities. Development is intended to begin in 2015 upon approval of this RAW and implementation of the remedial action.

Site Characterization

H&K performed a preliminary site investigation in 2010. Findings were presented in *Preliminary Soils Report for Nevada City Tech Center Housing Area* (H&K; July 26, 2010). The investigation identified surficial disturbance from shallow placer prospecting, as well as mine shafts associated with underground hard rock gold mining, at the locations depicted on Figure 2. Elevated concentrations of arsenic and lead were detected in soil near the mine shafts, which are referenced herein as the Crosby, Williams and New Shaft locations.

H&K prepared a *Draft Supplemental Site Investigation Work Plan* (October 15, 2014). The California Environmental Protection Agency (CalEPA) Department of Toxic Substances Control (DTSC) concurred with the draft work plan (December 15, 2014) and recommended minor revisions. H&K issued a *Final Supplemental*

Site Investigation Work Plan (December 30, 2014) and performed the supplemental site investigation (SSI) in January through May 2015.

Risk Assessment

The remedial procedures outlined herein are intended to achieve remedial action objectives (numerical cleanup goals) that are based on the findings of human health risk assessment (HHRA) and ecological screening assessment (ESA). Assessment findings are presented in Section 3 of this RAW.

Cost Analysis

The NCP requires the use of an Engineering Evaluation/Cost Analysis (EE/CA) or equivalent. This RAW is to serve as the equivalent of an EE/CA. Three remedial alternatives are evaluated, as presented in Sections 4 and 5 of this RAW. The evaluation of the remedial alternatives is based on effectiveness, implementability and cost. On-site management was selected as the preferred remedial alternative because it is considered to be cost-effective and protective of human health and the environment.

Proposed Remedial Measures

Elevated arsenic and lead concentrations are present in mine waste (naturally mineralized soil and rock) within the proposed development area at the Crosby and Williams locations. The mineralized soil and rock is to be removed from these locations and is to be buried with the remaining mine waste at the New Shaft location, which is to remain open space. The New Shaft location is to be subject to a land use covenant (LUC) so that future unauthorized disturbance of the mineralized soil and rock can be avoided. An estimated 1,710 cubic yards of mineralized soil and rock will be excavated from the Crosby and Williams locations and placed at the New Shaft location.

Restrictions on Site Use Prior to Remediation

If site activities are performed prior to the site remediation activities presented in this RAW, the remediation areas must be identified and marked in the field so that the areas may be avoided. Potential site activities that may result in disturbance of the mine waste stockpiles and impacted soil areas include timber harvest, grading and road construction, brush clearing for fire prevention, and other ground disturbing activities. DTSC must be allowed to review any proposed ground disturbing activities if the activities are to be performed prior to the implementation of the recommended remedial procedures.

Remedial Goals

This RAW establishes the following numerical cleanup goals for metals in soil:

Soil Cleanup Goals for Unrestricted Land Use

Constituent	**Cleanup Goal** (mg/kg)	**Basis for Cleanup Goal**	**UCL Goal** (mg/kg)
Arsenic	17.0	BTV (see Section 2.10)	13.3
Cobalt	15.0	BTV	13.78
Copper	75.8	BTV	58.55
Lead	140	BTV	80
Nickel	12.0	RBCL (see Section 4.5.1)	10.26
Selenium	<1	BTV	na
Zinc	36.1	BTV	29.2

BTV = background threshold value
RBCL = risk-based cleanup level
UCL = 95% upper confidence limit on the arithmetic mean
mg/kg = milligrams per kilogram

Mitigation of Physical Hazards

The abandoned mine excavations identified at the Site, including the Crosby Shaft, New Shaft, and associated underground workings, were the subject of subsurface geotechnical investigation (H&K, 2014B). Geotechnical conditions associated with the abandoned mine features are to be addressed as part of Site development under the oversight of the Nevada County Building Department. Geotechnical engineering recommendations pertaining to the mine features are presented in H&K's *Updated Geotechnical Engineering Report* (H&K, 2014B).

Dust Mitigation Plan

A Dust Mitigation Plan (DMP) is appended to this RAW and is intended to reduce the potential for exposure to naturally-occurring metals during the soil management activities. The DMP outlines engineering controls to be implemented during mechanical soil disturbance. Mechanical soil disturbance includes construction activities such as excavation, transport, grading, fill placement and underground utility work. In addition to following the specific soil management procedures approved by the DTSC, the contractor selected to perform the remedial action must develop a site specific health and safety plan to protect their workers, site visitors, and neighbors from potential exposure to metals in soil during the remedial action.

Verification Sampling and Analysis Plan

This RAW contains a Verification Sampling and Analysis Plan to establish post-remediation procedures for soil sampling, laboratory analysis and statistical evaluation to verify that the remedial goals were achieved.

Remedial Action Reporting

Upon completion of the soil management activities, a report is to be prepared documenting compliance with this RAW and presenting the results of verification soil sampling and analysis.

Public Participation

Section 25356.1 of the HSC outlines public participation requirements for the remedial action. Requirements include the preparation of a community profile report to determine public interest in the remedial action, notice of the RAW in a newspaper of general circulation, provision of a minimum 30-day public comment period, and preparation of a responsiveness summary. A community profile is appended to this RAW.

1 INTRODUCTION

Holdrege & Kull (H&K) prepared this Removal Action Work Plan (RAW) to describe remedial activities associated with mine waste (naturally mineralized soil and rock) at The Grove at Nevada City (the Site). The approximately 15-acre Site comprises the western portion of Nevada County Assessor's Parcel Number (APN) 05-190-53 and is located west of the existing Nevada City Tech Center campus in Nevada City, California.

The requirement for preparation of a RAW was created by Senate Bill 1706 in 1994. The RAW is one of two remedy selection documents that may be prepared for a hazardous substance release site pursuant to Section 25356.1 of the California Health and Safety Code (HSC). A RAW was chosen over a Remedial Action Plan because the proposed remediation is not an emergency action and the cost of the recommended remedial action is projected to be less than the threshold cost of one million dollars.

The remedial action outlined in this RAW is to be conducted in a manner consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; Title 40 Code of Federal Regulations [40 CFR] 300.400 et seq). The NCP requires the use of an Engineering Evaluation/Cost Analysis (EE/CA) or equivalent. This RAW is to serve as the equivalent of an EE/CA.

Section 25356.1 of the HSC outlines public participation requirements for the RAW. Requirements include the preparation of a community profile report to determine public interest in the remedial action, notice of the RAW in a newspaper of general circulation, provision of a minimum 30-day public comment period, and preparation of a responsiveness summary.

1.1 BASIS FOR REMEDIAL ACTION

Pursuant to Section 25356.1.5 of the California HSC, the proposed remedial action shall be based upon, and be no less stringent than:

- Requirements established under federal regulation pursuant to Subpart E of the NCP (40 CFR 300.400 et seq), as amended, which pertains to remedial action and selection of remedial alternatives;
- Regulations established pursuant to Division 7 (commencing with Section 13000) of the California Water Code, which pertains to state and regional water quality control;

- Applicable water quality control plans adopted pursuant to Section 13170 of the California Water Code;
- Article 3 (commencing with Section 13240) of Chapter 4 of Division 7 of the California Water Code, which pertains to water quality control plans and waste discharge requirements;
- Applicable state policies for water quality control adopted pursuant to Article 3 (commencing with Section 13140) of Chapter 3 of Division 7 of the California Water Code, to the extent that those policies are consistent with the federal regulations;
- Applicable provisions of the California HSC, to the extent those provisions are consistent with the federal regulations; and
- The risk assessment findings presented herein.

1.2 PURPOSE

The purpose of the RAW is to evaluate remedial alternatives and to select a remedial alternative that effectively reduces, to the extent feasible, the human health risks associated with the mineralized soil and rock at the Site. The evaluation considers the effectiveness, implementability and cost associated with each alternative. This RAW presents the recommended remedial action, as well as a verification sampling and analysis plan to confirm that the proposed remedial goals are achieved.

1.3 ORGANIZATION OF THIS DOCUMENT

Per Section 25323.1 of the HSC, a RAW must include a plan for conducting the remedial action, a description of the on-site contamination, the goals to be achieved by the remedial action, and the rationale for consideration of alternative removal options. This RAW contains components required by DTSC's *Removal Action Workplans* memorandum (September 23, 1998) and is organized in the following sections:

1. *Introduction*. This section includes an overview of the proposed remedial action and associated regulations, purpose of the RAW, its organization and limitations.
2. *Site Characterization*. This section includes site description, ownership and operational history, site conditions, findings of the site characterization, summary of quality assurance, nature and extent of contamination, and description of response actions taken, if any.

3. *Risk Assessment*. This section presents the findings of human and ecological risk assessment and evaluation of risk to water quality.

4. *Remedial Action Objectives*. This section includes a discussion of regulations, identification and review of applicable or relevant and appropriate requirements (ARARs), identification of media and constituents of concern, estimate of volumes, and remedial action goals.

5. *Evaluation of Remedial Action Alternatives*. This section includes a listing of alternative remedial measures and basis for selection of the recommended measure.

6. *Health and Safety Plan*. This section includes a brief overall description of the methods that will be employed during the removal action to ensure the health and safety of workers and the public during the removal action.

7. *Remedial Procedures and Implementation*. This section includes a description of techniques and methods to be employed in the remedial action, including excavation, storing, handling, transportation, treating and disposing of material on or off the site, as applicable. The Verification Sampling and Analysis Plan (VSAP), which is intended to confirm the effectiveness of the RAW, is discussed in this section.

8. *Public Participation*. This section includes a discussion of public participation in the remedial action.

9. *Remedial Action Reporting*. This section includes a brief description of the post-remediation report which is to be prepared to summarize remedial activities and to document compliance with the RAW.

10. *References*. This section presents a list of references cited in this document.

Appendix A presents a list of administrative record documents for the remedial action.

1.4 LIMITATIONS AND EXCEPTIONS

The information provided in this plan is not meant to be comprehensive, to identify all potential concerns, or to eliminate the risk associated with environmental conditions. H&K used professional judgment and experience to arrive at the conclusions presented herein. Therefore, the conclusions are not to be considered scientific certainties. The recommendations provided herein are contingent upon H&K's review of future sampling results and any other pertinent information that becomes available.

No environmental assessment can eliminate all uncertainty. H&K does not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan. Furthermore, the concentrations detected in the samples collected during the site investigation may not be representative of conditions between the locations sampled. Other forms of contamination may be present within the site that the investigation did not detect. Professional judgment and interpretation are inherent in the process and uncertainty is inevitable. Therefore, the recommendations presented in this plan may need to be revised based on site conditions encountered during the soil management.

H&K prepared and issued this plan for the exclusive use of our client. Any reliance on this plan by a third party is at the party's sole risk. H&K is not responsible for any other party's interpretations of the reported information.

H&K performed this work in accordance with present, regional, generally accepted standards of care. This report does not represent a legal opinion. No warranty, expressed or implied, including any implied warranty of merchantability or fitness for the purpose is made or intended in connection with the work.

The findings of this report are valid as of the present date. However, changes in the conditions of the property can occur with the passage of time. The changes may be due to natural processes or to the works of man, on the project site or adjacent properties. Changes in regulations, interpretations, and/or enforcement policies may occur at any time. Such changes may affect the extent of mitigation required.

If changes are made to the nature or design of the Project as described in this plan, then the conclusions and recommendations presented in this plan should be considered invalid by all parties. Only H&K can determine the validity of the conclusions and recommendations presented in this plan. Therefore, H&K should be retained to review all project changes and prepare written responses with regards to their impacts on H&K's conclusions and recommendations.

H&K is not responsible for the health and safety of non-H&K personnel, on or off the project site. The contractor is responsible for work site conditions.

2 SITE CHARACTERIZATION

2.1 KEY SITE INFORMATION

Key Site information is summarized below:

Site Identification

105-191 Providence Mine Road, Nevada City, CA 95959
APN 05-190-053
Nevada City, Nevada County, California

Owner

Nevada City Tech Center, LLC
12555 Dunbar Road
Glen Ellen CA, California 95442

Point of Contact

Mr. Robert Upton
Phone: (707) 721-1193

2.2 SITE LOCATION AND DESCRIPTION

The Site is a 15-acre proposed residential development comprising the western portion of Nevada County Assessor's Parcel Number (APN) 05-190-53. The Site is located east of an existing unnamed road and west of the Nevada City Tech Center campus in Nevada City, California.

The Site is a portion of the northwest quarter of Section 13, Township 16 North, Range 8 East, based on the Mount Diablo geodetic datum. A vicinity map and site map are presented as Figure 1, which was prepared by KPFF Consulting Engineers (September 2013).

2.2.1 Land Use

The Site is currently undeveloped and vacant, and is located within the city limits of Nevada City near its western border. According to the County of Nevada Geographic Information System (GIS; http://gis.nevcounty.net/MyNeighborhood/), the parcel is zoned as high density residential.

2.2.2 Adjacent Properties

The Site is bordered to the north and east by the Nevada City Tech Center and to the south and west by developed and undeveloped residential property.

2.2.3 Physical Setting

The Site is situated in the Sierra Nevada physiographic province at elevations ranging from approximately 2,460 to 2,600 feet above mean sea level. The southern portion of the property is relatively flat-lying, while other portions of the site slope moderately to steeply towards a seasonal drainage course known as Peck Ravine. Regional native vegetation typically includes mixed conifer and oak woodlands.

2.2.4 Geologic Conditions

According to Lindgren (1896), the Site is located on a narrow belt of Calaveras slate bounded by diabase (to the southwest) and granodiorite (to the northeast). Clark (1998) describes the geology as slate, schist and quartzite located between greenstone and amphibolite to the southwest and granitic rocks to the northeast. Several gold-bearing quartz veins are mapped near these geologic contacts, one of which strikes southeast across the property and dips toward the northeast.

2.2.5 Soil Conditions

H&K reviewed the online USDA soil survey accessed through the U.C. Davis California Soil Resource Laboratory web site. The soil survey indicated that several dominant soil classifications exist on the Site, including Musick sandy loam, Hoda sandy loam, Secca-Rock outcrop complex, and Josephine loam.

According to the soil survey, the northern half of the Site is mapped as Musick sandy loam. The Musick soil type is described as well drained residual soil underlain by weathered granodiorite. The surface horizon of the Musick soil profile typically consists of 25 inches of brown and reddish-brown sandy loam, light loam, and loam. The surface soil is typically underlain by approximately 73 inches of yellowish red and red heavy clay loam and variegated reddish yellow and yellow loam. Weathered granodiorite is encountered at a depth of approximately 98 inches below the ground surface (bgs). For the Musick sandy loam, 15 to 50 percent classification, up to 10 percent of the surface can consist of rock outcrop.

The southern half of the Site is mapped as Hoda sandy loam (northern portion), Secca-Rock outcrop complex (southwestern portion) and Josephine loam (southeastern portion).

The soil survey describes the Hoda series soil as consisting of well-drained soil underlain by weathered granodiorite. The surface soil typically consists of 12 inches of brown sandy loam. The surface soil is typically underlain by reddish yellow loam, yellowish red clay, and yellowish red sandy clay loam to an approximate depth of 63 inches or more bgs.

The Secca soil type is described as moderately well drained residual soil underlain by metabasic or basic rock. The typical Secca soil profile includes 15 inches of brown and reddish brown gravelly silt loam. This surface soil is underlain by 30 inches of yellowish red, cobbly silty clay loam, strong brown cobbly clay, and light yellowish brown gravelly light clay. Variably weathered rock is typically encountered at an approximate depth of 45 inches bgs. The soil survey notes that areas mapped as Secca-Rock outcrop complex contain 10 to 40 percent rock outcrop.

The soil survey describes the Josephine series soil as consisting of well-drained soil underlain by vertically tilted slate, shale, and contact metamorphic rock. The surface soil typically consists of 18 inches of reddish-brown loam and gravelly loam. The surface soil is typically underlain by reddish yellow silty clay loam. Weathered slate and shale are typically encountered at a depth of 70 inches bgs.

2.2.6 Groundwater Conditions

Well completion reports were obtained from the California Department of Water Resources (DWR) in an attempt to identify nearby groundwater wells (municipal, domestic and agricultural). According to the well completion reports provided by DWR, at least 15 domestic wells are located within a 0.5 mile radius of the Site.

The closest identified well was located on a property approximately 1,890 feet to the east of the Site. The total depths of the wells ranged from 125 feet and 900 feet. Depth to first water in the wells ranged from 43 to 390 feet. The Site is lower in elevation than the wells identified to the west, south, and east. The Site is at equal and higher elevation than wells identified to the north and northwest. However, the wells identified to the north and northwest are on the opposite side of Deer Creek.

2.2.7 Surface Water Conditions

The Site is located on and near the banks of Peck Ravine, an ephemeral drainage course, approximately 1,200 feet southeast of Deer Creek. Property elevations range from approximately 2,460 to 2,600 feet above mean sea level. The southern portion of the property is relatively flat-lying, while other portions of the site slope moderately to steeply towards Peck Ravine.

2.3 SITE HISTORY

The Site is located within the historic Nevada City gold mining district, on the southern edge of the Champion group of mines. Review of historical mining maps identified two inclined shafts at the Site, several spoils piles, and evidence of near-surface prospecting. The Site vicinity is underlain by deeper workings associated with the Providence and Mountaineer mines.

2.3.1 Historical Records

H&K reviewed selected portions of the following documents and maps for historical mining information pertaining to the Site location:

- Master Title Plat ca210160n0080e0-1004, No. 3, Supplemental Sections 13, 14, 21 and 29. United States Bureau of Land Management (BLM), Folsom Field Office, last modified February 10, 2009. Accessed at http://www.blm.gov/ ca/forms/mtp/search.php on January 6, 2010.
- Mineral Survey Plat 52, Plat of the Providence Gold Quartz Claim. March 1869. Obtained from the BLM Folsom Field Office.
- Mineral Survey Plat 1895, Plat of the Claim of A. Walrath upon the Williams Placer Mine and Included Lodes, Gold Flat Mining District, Nevada County, California. February 1882. Obtained from the BLM Folsom Field Office.
- Mineral Survey Plat 5123, Plat of the Claim of North Star Mines Company, a corporation, known as the Peck Fraction Lode. November 1914. Obtained from the BLM Folsom Field Office.
- Maps of the *Nevada City Special Folio*. U.S. Geological Survey Folio 29, Waldemar Lindgren, 1896.
- Map of the Nevada City Mining District. Edward Uren, 1924.
- Maps of the *Mineral Land Classification of Nevada County, California*. Special Report 164, California Department of Conservation Division of Mines and Geology (CDMG), 1990.
- *Gold Districts of California*. William B. Clark, Department of Conservation, Division of Mines and Geology, Bulletin 193, manuscript submitted 1963 with some revisions through 1969, seventh printing 1998.
- Map of the Vicinity of Grass Valley/Nevada City, Charles Uren, 1897.
- *The Gold-Quartz Veins of Nevada City and Grass Valley Districts, California*. Extract from the Seventeenth Annual Report of the Survey, 1895-96, Part II – Economic Geology and Hydrography. Waldemar Lindgren, USGS, 1896.

- Map of Nevada County Mining District (J.G. Hartwell, County Surveyor, 1880).
- Mines and Mineral Resources of Nevada County, Chapters of State Mineralogists Report, Biennial Period 1917-1918. Errol Mac Boyle, California State Mining Bureau, 1918.

2.3.2 Mine Features Identified at the Site

According to the map Topography – Southwest of the *Nevada City Special Folio* (Lindgren, 1896), the northern half of the Site was part of the Providence hard rock gold mining claim, and the southern portion of the Site was part of the Williams placer gold mining claim.

The folio map Economic Geology – Southwest, depicts the New Shaft near the northeastern Site boundary and the Crosby Shaft in the southern portion of the Site. Both shafts reportedly dip to the northeast. Four spoils piles are depicted in the vicinity of these shafts.

The Map of the Nevada City Mining District (Uren, 1924) also depicts the New Shaft and the Crosby Shaft, as well as associated underground workings. According to the Uren map, the northern two-thirds of the Site location was part of the Mountaineer claim, and the southern third of the Site was part of the Peck No. 1 claim. Tunnels extend from both shafts at several levels, one of which is depicted as connecting the two shafts. The map indicates that stoping from the tunnel level extended towards the ground surface near both shaft locations, as well as in the central portion of the Site. The map also depicts deeper workings crossing underneath the vicinity of the Site, including the 1750 level of the Wyoming mine as well as tunnels apparently associated with the Providence mine.

Plate 2a of the *Mineral Land Classification of Nevada County, California* (CDMG, 1990) depicts the New Shaft and Crosby Shaft at the Site location, referencing Plate 3 of the *Report of the State Mineralogist XXXVII* (1941).

Lindgren (1896) mentions the New Shaft and Crosby Shaft in association with the Providence Mine on the Merrifield Vein. Plate XXI of the document is a horizontal projection of workings on the Merrifield Vein near the New Shaft. As indicated on page 209 of the document, the features depicted on Plate XXI are intended to illustrate the geology, and not all underground features are reported. The Merrifield Vein is described as dipping 35 degrees to the east on average, ranging from 29 to 45 degrees. The vein is described as typically 6 inches to 4 feet wide, although the altered rock is reportedly up to 20 feet thick.

Mineral Survey Plat No. 1895 (1882) depicts the Williams Placer Mine claim circa 1882 on the southern end of the Site location, as well as the Peck No. 1 Lode and the location of a hoisting works located near the Crosby Shaft location as depicted by Lindgren (1896).

2.3.3 Mine Features Identified in the Site Vicinity

The historical sources H&K reviewed depicted approximately 40 historic mines or mine claims located within approximately ½ mile of the Site. The mine claims included the Champion Group mines (Bayard Taylor, Deer Creek/Cadmus, Merrifield/Nevada Gold Quartz, Nevada City, New Years, North Home, East Home, South Home, Phillips, Providence, Ural and Wyoming), Mountaineer Mine Company claims (including the Dodo, Live Yankee, Perseverance, Fortuna, Summit, Mountaineer and Orleans), Aurora Star, Bodie Creek, California Consolidated, Reward, Emma, General Grant Placer, Germany, Layton Placer, Luetje/Schwartz claim, McCauley Placer/Quartz, Mohigan (Mohican), Muller, Peck, Plumas Nevada, Queen Lil', Red Hill Prospect, Shanghai Placer, Thomas and Walrath.

H&K's previous assessment of land to the west of the Site, across Peck Ravine, encountered metals concentrations in mining spoils that were generally within the range of regional background soil metals concentrations. Higher metals concentrations have been detected by H&K and others near the banks of Deer Creek, approximately 1,000 feet north of the Site and at lower elevations than the Site elevations. This mining waste is typically associated with the deeper workings of the Champion Group of mines and the Mountaineer Mining Company claims.

The Champion Group mines were primarily located to the north of the Site, across Deer Creek. The Champion Group was owned by North Star Mines Company and was managed by A.D. Foote. The claims comprised approximately 440 acres, including approximately 8,000 feet of the Ural and Merrifield veins. According to Mac Boyle (1918), the principal producing mines were the Champion, Home, Nevada City, Providence and Wyoming.

The Providence Mine was part of the Champion Group and was located on the southern bank of Deer Creek, down slope of the Site. Mine waste in this area was characterized by Friends of Deer Creek in cooperation with the City of Nevada City as part of a Community Wide Brownfield Assessment, which was funded by USEPA Region IX. USEPA recently funded a partial cleanup of the Providence Mine site, which was performed in 2014/15.

2.3.4 Previous Assessment Documents

Previous Site assessment is summarized in the following documents:

- Geotechnical Engineering Report, Nevada City Tech Center, (H&K; July 2006);
- Preliminary Soils Report, Nevada City Tech Center Housing Area, (H&K; July 2010);
- Soil Management Plan, The Grove at Nevada City, (H&K; January 2014);
- Updated Geotechnical Engineering Report, The Grove at Nevada City, (H&K; 2014B).

2.3.5 Summary of Previous Assessment

H&K's previous investigation of the Site is summarized in the *Preliminary Soils Report for Nevada City Tech Center Housing Area* (H&K; July 26, 2010). The investigation included records review, surface reconnaissance, soil sampling and laboratory analysis. Twenty discrete soil samples obtained from the property were analyzed for total arsenic, lead and mercury by SunStar Laboratories, Inc. (ELAP No. 2250) of Lake Forest, California. Total arsenic and lead were analyzed by US EPA Method 6010B, and total mercury was analyzed by US EPA Method 7471A. H&K's 2010 report describes the sampling, analysis and quality control procedures. Sample locations are depicted on Figure 2, and laboratory results are summarized in Tables 1 and 2. Laboratory reports and chain of custody documents are presented in Appendix B.

2.4 NATURE AND EXTENT OF CONTAMINATION

An estimated 2,500 cubic yards of mine waste (soil and rock) with elevated concentrations of arsenic and lead (resulting from natural mineralization) have been identified at the Site in three locations (the Crosby, Williams and New Shaft locations). Some of the arsenic and lead concentrations detected in the mine waste exceed local background concentrations and present a health risk in the case of routine, long-term exposure to the mine waste (i.e., inhalation of soil dust, incidental ingestion or dermal contact with the soil). This plan outlines procedures for management of soil and rock with naturally-occurring metals concentrations that exceed local background levels. The procedures are intended to reduce the chance of future contact with the mineralized soil and rock by excavation of approximately 1,710 cubic yards of mineralized soil and rock from the Crosby and Williams locations (within the proposed development area) and placement of the mineralized soil and rock at the New Shaft location (in open space) under land use controls to prevent future unauthorized disturbance.

2.5 PREVIOUS RESPONSE ACTIONS

No previous response actions have been performed at the Site.

2.6 PROPOSED DEVELOPMENT

Development plans prepared by KPFF Consulting Engineers (September 2013) indicate that the proposed development will include approximately 59 residential units, paved roads, and underground utilities. The southern third of the Site is to support multi-family residential units, and the remainder of the Site is to support low-density single-family residential lots and open space. Development is intended to begin in 2015 upon approval of this RAW.

2.7 COMMUNITY PROFILE

A community profile and demographic information is presented in Appendix C. The Site is located within the city limits of Nevada City, in Nevada County, California. No specific language considerations have been identified for the Site vicinity. The population of Nevada County is primarily white middle/working class, based on demographic information listed on the U.S. Census Bureau website for the 2000 census. H&K is not aware of any past public involvement, media coverage or issues specific to the Site. The site is partially visible from one nearby single-family residential property, but is otherwise generally not visible from neighboring properties.

2.8 SUMMARY OF SITE INVESTIGATION PROCEDURES

Site investigation, including historical research, soil sampling and total metals analysis, was performed in 2010. Findings of the site investigation are presented in the *Preliminary Soils Report for the Nevada City Tech Center Housing Area* (H&K, 2010) and are summarized below.

Supplemental site investigation (SSI) was performed in January through May 2015 pursuant to the DTSC-approved Final SSI Work Plan (H&K, 2014C). The purpose of the SSI was to further characterize mine waste (naturally mineralized soil and rock) identified at the Site, and to support human health risk assessment (HHRA) and ecological scoping assessment (ESA) (see Section 3 of this RAW).

The scope of the SSI is summarized below:

- Twelve discrete mine waste characterization samples were obtained from four exploratory trenches advanced through mining waste at the Crosby and New Shaft locations. Samples were obtained from three depth intervals within each exploratory trench (typically from 0-2 feet below ground surface [bgs], 3-5 feet bgs, and 6-8 feet bgs).
- An additional thirty-three soil samples were obtained from 0-6 inches bgs to characterize surface conditions around the mine waste stockpiles and elsewhere at the Site.
- Samples were delivered to a state-certified analytical laboratory under chain of custody documentation for analysis of total and extractable metals, Acid Base Accounting (ABA) and paste pH.

2.8.1 Soil Sampling Procedures

Exploratory trenches (two within the Crosby spoils and two within the New Shaft spoils; TC-21, TC-22, TC-30 and TC-31, as depicted on Figure 2) were excavated to a maximum depth of eight feet below the ground surface using a track-mounted mechanical excavator. Three samples were obtained from each exploratory trench at depth intervals of 0-2 feet bgs, 3-5 feet bgs, and 6-8 feet bgs.

To characterize the lateral extent of mineralization, H&K obtained 33 shallow (0-6 inches bgs), discrete soil samples using hand tools.

All samples were collected using clean, stainless steel trowels and disposable plastic scoops, and were transferred to re-sealable plastic bags, which were immediately sealed, labeled, and placed in a thermally-insulated container for transport to the analytical laboratory. Clean sampling equipment was used for each sampling location or was washed with laboratory-grade detergent and rinsed between sampling locations. The samples were labeled and delivered by courier to a California-certified analytical laboratory using chain-of-custody documentation.

2.8.2 Analytical Testing

Advanced Technology Labs, Inc. (ATL; ELAP No. 1838) performed total and soluble metals analysis. ACZ Laboratories (ACZ; NELAP No. 05236CA) performed Acid-Base Accounting (ABA), paste pH analysis and soluble metals analysis.

2.9 SUMMARY OF SITE INVESTIGATION RESULTS

Laboratory results are summarized in the attached Tables 1 through 4. Laboratory reports, including method detection limits, reporting limits, chain of custody documentation and laboratory QA/QC findings are presented in Appendix B. Analysis and findings are summarized below:

- Twelve mine waste characterization samples (TC-21A, -B and -C; TC-22A, -B and -C; TC-30A, -B and -C; and TC-31A, -B and -C) were analyzed for total Title 22 metals by EPA methods 6010B and 7471A. The maximum detected arsenic (37 mg/kg) and cobalt (66 mg/kg) concentrations exceed the corresponding Regional Screening Levels (RSLs) for arsenic (0.07 mg/kg) and cobalt (23 mg/kg) in residential soil. The maximum detected lead concentration (920 mg/kg) exceeds a benchmark concentration of 80 mg/kg for lead in residential soil based on the LeadSpread 8 model (DTSC, 2011). The maximum detected total arsenic, lead and cobalt concentrations detected in mine waste (37, 920 and 66 mg/kg, respectively) are lower than the corresponding Total Threshold Limit Concentration (TTLC) values (500, 1000 and 2500 mg/kg, respectively).
- Four mine waste characterization samples (TC-21A, TC-22C, TC-30B, and TC-31A) were tested for ABA (EPA method 600/2-78-054) and paste pH. Sulfate sulfur content was less than 0.01 percent, paste pH ranged from 5.1 to 6.5, and the ratios of neutralizing potential to acid generating potential were generally greater than 3:1, indicating that the potential for acid generation is low.
- Total lead concentrations detected in samples TC-22A, TC-22B, and TC-22C exceeded ten times the Soluble Threshold Limit Concentration (STLC); therefore, solubility testing for lead was performed using the Title 22 Waste Extraction Test using deionized water as the extractant solution (DI-WET). Deionized water was selected based on the ABA results described above, pursuant to the Designated Level Methodology (RWQCB, 1989). The maximum detected soluble lead concentration was 2.1 micrograms per liter (ug/L) of extractant solution.
- Samples TC-1 through TC-20, TC-23 through TC-29, and TC-32 through TC-57 were analyzed for total arsenic, lead and mercury by EPA methods 6010B and 7471A. Twelve of the development area samples were analyzed for total chromium, cobalt, copper, nickel, selenium, vanadium and zinc by EPA method 6010B.

The following sections summarize concentration ranges of the sample results for specific analytes.

2.9.1 Total Metals in Soil

Waste Characterization Samples

Twelve discrete soil samples were selected from three trenches for waste characterization and were analyzed for Title 22 metals. An additional eight discrete soil samples obtained from the upper 0.5 feet of the waste piles were analyzed for total arsenic, lead and mercury. Results are summarized below:

- Antimony was not detected above the laboratory reporting limit of 2.0 mg/kg.
- Arsenic concentrations ranged from 4.1 mg/kg to 37 mg/kg.
- Barium concentrations ranged from 22 mg/kg to 250 mg/kg.
- Beryllium concentrations ranged from below a laboratory reporting limit of 1.0 mg/kg to 2 mg/kg.
- Cadmium was not detected above the laboratory reporting limit of 1.0 mg/kg.
- Chromium concentrations ranged from 5.4 mg/kg to 44 mg/kg.
- Cobalt concentrations ranged from 6.1 mg/kg to 81 mg/kg.
- Copper concentrations ranged from 22 mg/kg to 73 mg/kg.
- Lead concentrations ranged from 2.2 mg/kg to 920 mg/kg.
- Mercury concentrations ranged from below a laboratory reporting limit of 0.1 mg/kg to 0.37 mg/kg.
- Molybdenum concentrations ranged from below a laboratory reporting limit of 0.1 mg/kg to 8.9 mg/kg.
- Nickel concentrations ranged from 3.7 mg/kg to 28 mg/kg.
- Selenium concentrations ranged from below a laboratory reporting limit of 1.0 mg/kg to 1.4 mg/kg.
- Silver concentrations ranged from below a laboratory reporting limit of 1.0 mg/kg to 2.5 mg/kg.
- Thallium was not detected above a laboratory reporting limit of 1.0 mg/kg.
- Vanadium concentrations ranged from 45 mg/kg to 110 mg/kg.
- Zinc concentrations ranged from 19 mg/kg to 110 mg/kg.

None of these samples exceeded their respective TTLCs. Table 1 summarizes the results.

Development Area Soil Samples

Fifty-three discrete soil samples were obtained from around the mine waste stockpiles and from elsewhere in the proposed development area to characterize the lateral extent of mineralization. These samples were analyzed for total arsenic, lead, and mercury. Results are summarized below:

- Arsenic concentrations ranged from 3.4 mg/kg to 38 mg/kg.
- Lead concentrations ranged from 2.8 mg/kg to 140 mg/kg.
- Mercury concentrations ranged from less than a detection limit of 0.1 mg/kg to 1.3 mg/kg.

Background Soil

Background data were obtained as follows:

- Background soil arsenic data were obtained from local DTSC-approved sites as described in Section 2.10.
- Background soil lead and mercury data were obtained as a subset of the development area soil data, after statistical evaluation and removal of outliers.
- Background soil data for chromium, cobalt, copper, nickel, selenium, vanadium and zinc were obtained from the development area at locations away from the mine waste piles.

Background data are evaluated in Section 3.1 of this RAW.

2.9.2 Soluble Metals in Soil by DI WET

Extraction testing for lead was performed by DI-WET for the three samples with the highest total lead concentrations (samples TC-22A, TC-22B, and TC-22C). Deionized water was selected based on the ABA results described below, pursuant to the Designated Level Methodology (RWQCB, 1989). Soluble lead concentrations ranged from 0.3 ug/L to 1.2 ug/L. Table 3 summarizes the results.

2.9.3 Acid Base Accounting

Table 4 presents the ABA results for waste characterization samples TC-21A, TC-22C, TC-30B, and TC-31A. Acid Generation Potential (AGP) values range from 0.6 to 1.3 tons $CaCO_3$/1000 tons, and Neutralization Potential (NP) values range from 3.0 to 5.0 tons $CaCO_3$/1000 tons. Paste pH values range from 5.1 to 6.5. Total sulfur values range from less than 0.01 to 0.02 percent, pyritic sulfur values range from 0.02 to 0.04 percent, and sulfate sulfur values were less than 0.01 percent.

NP:AGP ratios for TC-21A, TC-22C, TC-30B, and TC-31A are 2.3, 3.1, 6.7 and 8.3, respectively. Considering the low sulfate content and the mean NP:AGP ratio (4.1), the mine waste as a whole is considered acid neutralizing.

2.10 LOCAL BACKGROUND SOIL ARSENIC CONCENTRATIONS

In the Nevada City and Grass Valley area, arsenic is known to occur in soil at concentrations exceeding typical regulatory benchmarks for arsenic in residential soil. Therefore, a discussion of regional background soil arsenic concentrations is informative with respect to risk management decisions involving arsenic in soil.

H&K compiled background soil arsenic data for eight local assessments performed under the Cal-EPA Department of Toxic Substances Control (DTSC) Voluntary Cleanup Program, including the Spring Hill, North Star, Kenny Ranch, Winds Aloft, Osborne Hill, Loma Rica, La Barr Meadows and Bear River Mill properties. Background arsenic data are presented in Appendix D. DTSC has reviewed and approved the investigation reports for which the background data were obtained.

The 208 local background arsenic concentrations, listed in Table 1 of Appendix D, range from non-detect to 48 milligrams per kilogram (mg/kg). The mean is 5.3 mg/kg, the standard deviation is 6.9 mg/kg and the coefficient of variation is 1.3. Descriptive statistics for the non-transformed and base 10 log-transformed data are presented in Appendix D.

The DTSC (1997, 2007) provides a framework in which risk assessors may identify background arsenic concentrations. Based on these guidance documents, visual and statistical evaluation of the regional background arsenic data were performed as described below.

Microsoft Excel Analyze-it™ version 1.73 was used to prepare normality plots of the non-transformed and log-transformed data. The plots are presented in Appendix D, and descriptive statistics are summarized in Tables 2 and 3 of Appendix D. The non-transformed data are clearly not normal, as is often the case with trace metals. Although the log-transformed data generally display a linear distribution, the log-transformed data are not normally distributed based on the Shapiro-Wilk normality test. The coefficient of variation, as well as gaps and inflections observed in the log-transformed data, attest to the fact that the data were obtained from different sites and different geologic units.

With the exception of the Winds Aloft site, the eight background data locations share similar geology. Published geologic descriptions generally indicate that the sites are underlain by quartz diorite, diabase and/or ultramafic rock, as plotted on the QAP diagram presented as Figure 1 in Appendix D. The QAP in Figure 1 is a simplified depiction of the compositional ratio of quartz (Q), alkali feldspar (A), and plagioclase feldspar (P) in igneous plutonic rocks mapped at seven of the eight locations. Specific geologic descriptions are presented in Table 4 of Appendix D.

Outlying data were evaluated using the fourth spread procedure described by DTSC (2007). The fourth spread, f_s, is defined as the measure of spread in a data set that is resistant to outliers and is calculated according to the following equation: $f_s = Q_3 - Q_1$. By definition, any observation farther than $1.5f_s$ from the closest fourth is considered an outlier. For the log-transformed data set, $1.5f_s$ is equal to 1.25, and any observation below $Q_1 - 1.5f_s$ or above $Q_3 + 1.5f_s$ would be considered an outlier. By this method, none of the data were determined to be outliers.

The 95th percentile value for the local background arsenic data set is 17 mg/kg. This value may be considered a background threshold value representing local background soil arsenic concentrations.

2.11 QUALITY ASSURANCE

The SSI was conducted in accordance with the Quality Assurance Project Plan (QAPP) presented in the SSI Work Plan (H&K; 2014C). The QAPP is based on guidelines set forth in *EPA Requirements for QA Project Plans* (EPA QA/R-5, May 2001) *Guidance for Quality Assurance Project Plans* (EPA QA/G-5, December 2002).

The QAPP documents the results of the project's technical planning process, identifies key project personnel, and provides a plan for the environmental data operation and its quality objectives. The purpose of the QAPP is to specify procedures to be followed to maintain consistent quality of field and laboratory data.

2.11.1 Special Training Requirements

Key H&K personnel for this project included Bryan Botsford, Staff Geologist, and Jason Muir, P.E., G.E., Project Manager. Field work was performed under Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910). Analytical laboratories were certified by the State of California.

2.11.2 Documentation and Records

The QAPP was distributed to the project staff by the Project Manager. Project staff reviewed the pertinent sections of the work plan and QAPP prior to performing the relevant tasks. Individual personnel field notebooks for the project, GPS data, chain of custody documentation, field maps and photographs are maintained at H&K's Nevada City office for a period of five years following the investigation. Approved documents, including the SSI Work Plan and RAW, are to be retained on DTSC's publically-accessible Envirostor website.

2.11.3 Quality Control

The following quality control procedures were employed:

- One field-split duplicate sample was obtained for every 20 soil samples and was be analyzed to assess comparability and precision (samples TC-31B-DUP, TC-47-DUP and TC-57-DUP).
- One co-located sample was obtained for every 20 soil samples and was analyzed to assess representativeness (samples TC-21B-CO, TC-37-CO and TC- 54-CO).
- Laboratory quality control procedures such as method blanks and matrix spike samples were performed by the laboratory to assess accuracy and bias (Appendix B).

2.11.4 Data Validation

Data were validated based on an estimate of the potential error from field, laboratory, and data manipulation. The evaluation was performed with regard to the DQIs (data quality indicators): precision, bias, accuracy, representativeness, comparability, completeness, and sensitivity. Based on the evaluation results, the SSI data were accepted without qualification. The evaluation is summarized below.

<u>Precision</u>

The precision of laboratory analysis was assessed by comparing the analytical results with laboratory duplicate results for inorganic analysis. Relative percent difference (RPD) was calculated for each pair of duplicate analyses using the following equation:

$$RPD\ [\%] = 2\left[\frac{\mathrm{abs}(Co - Cd)}{\mathrm{Co} + \mathrm{Cd}}\right]100$$

where:
RPD = relative percent difference
Co = concentration of compound original sample
Cd = concentration of compound in duplicate sample
abs = absolute value

The performance goals for laboratory precision are: (1) RPD between laboratory duplicate samples less than or equal to 30% for analyte concentrations greater than or equal to five times the method detection limit (MDL), (2) and the absolute concentration difference less than or equal to the MDL for analyte concentrations less than five times the MDL.

RPD values for the three co-located sample pairs (TC-21B/TC-21B-CO, TC-37/TC-37-CO and TC-54/TC-54-CO) and the three field-split duplicate sample pairs (TC-31B/TC-31B-DUP, TC-47/TC-47-DUP and TC-57/TC-57-DUP) were below 30% with the exception of the RPD for total cobalt (46.8%) in sample pair TC-31B/TC-31B-DUP.

Accuracy

The accuracy of laboratory results is generally assessed using method blank, reagent and preparation blank, laboratory control, laboratory duplicate, matrix spike / matrix spike duplicate (MS/MSD), and post spike analytical results. The percent recovery (%REC) of MS is calculated as follows:

$$\%REC\ [\%] = \left[\frac{Cm}{\mathrm{Co}}\right] 100$$

where:
%REC = percent recovery
Cm = measured analyte concentration
Co = known (matrix spike) concentration

Laboratory quality control/quality assurance reporting is presented in Appendix B and is summarized below.

ATL Work Order 1500294 – Mine Waste Characterization

ATL reported that the matrix spike and matrix spike duplicate recovery was outside acceptance limits for lead. ATL reported that the analytical batch was validated by the laboratory control sample.

ATL reported that the RPD value for lead in the matrix spike duplicate samples was outside acceptance criteria, and that the calculation was based on raw values.

ATL Work Order 1500603 – Development Area Soil Characterization

ATL reported that the matrix spike recovery was outside acceptance limits for mercury in the matrix post spike sample. ATL reported that the analytical batch was validated by the laboratory control sample.

ACZ Work Order L22463 – Acid-Base Accounting

ACZ reported that the RPD for sulfate sulfur failed the control limits. However, the calculations passed on the two analyses utilized to calculate the sulfate sulfur. ACZ reported that no significant impact on the data would be expected.

Pyritic sulfur concentrations exceeded total sulfur concentrations in samples TC-21A, TC-22C, TC-30B, and TC-31A. These concentrations were between the MDL and RL, and the associated values are considered estimated quantities.

Representativeness

To assess representativeness, RPD of co-located and field-split duplicate samples were calculated, and laboratory blank samples were evaluated for the presence of contaminants. Results are discussed above.

Comparability

Comparability is addressed by keeping field and analytical methods consistent throughout the project, as specified in the QAPP and SSI Work Plan.

Completeness

Data review was performed to assess the accuracy of data recordation, processing and transmittal. Field and laboratory quality control data were reviewed for completeness. Sample preservation and holding times were verified.

In general, field measurements are expected to provide data which at least 90% meet the QC acceptance criteria, and laboratories measurements are expected to provide data which at least 95% meet the QC acceptance criteria. When at least 95% of the laboratory data meet these criteria, the data sets are considered complete. Percent completeness is calculated as follows:

$$\%C\ [\%] = \left[\frac{Na}{\mathrm{Np}}\right] 100$$

where:
%C = percent complete
Na = actual number of samples obtained, analyzed and validated
Np = proposed number of samples (from the work plan)

A total of 71 samples were obtained for total metals analysis. Of these 71 samples, 70 were analyzed without any QA flags, and one sample (TC-31B) was qualified with an RPD exceedance. Based on this information, percent complete (%C) was calculated to be 98.5%.

Sensitivity

Laboratory analytical methods were selected so that the method detection limits (MDLs) for most target analytes are less than the applicable regulatory screening criteria (i.e., RSLs and water quality goals) and/or local background concentrations. Comparison of MDLs and screening criteria, as listed in the work plan, indicates that the selected analytical methods are capable of quantifying most analytes at concentrations that are suitable for risk assessment.

Soluble lead analysis for samples TC-22A, TC-22B, and TC-22C was initially analyzed by DI WET / EPA 6010, but the detection limit (1000 ug/L) exceeded applicable water quality objectives. Soluble lead analysis for samples TC-22A, TC-22B, and TC-22C was repeated by DI WET / EPA 6020 ICP-MS with a MDL of 0.1 ug/L.

3 RISK ASSESSMENT

3.1 HUMAN HEALTH RISK ASSESSMENT

A human health risk assessment was performed in general accordance with guidelines set forth in DTSC's Human Health Risk Assessment (HHRA) guidance (available online at http://www.dtsc.ca.gov/assessingrisk/humanrisk2.cfm). HHRA methodology and results are summarized below, and calculations are presented in Appendix E.

3.1.1 Exposure Pathways and Media of Concern

Exposure media for the site are soil and air (suspended particulates). Exposure pathways are incidental ingestion and dermal contact with the affected soil, and inhalation of particulates originating from the affected soil. A conceptual site model diagram is presented as Figure 3.

Groundwater and surface water pathways are not considered complete. The mining waste is not subject to seasonal inundation or concentrated surface water flow, the mine waste is net acid-neutralizing, and soluble metals were detected only at low concentrations (see Section 3.3).

The constituents of potential concern (metals and metalloids) are not volatile, with the exception of mercury, and the low mercury concentrations detected in soil are not considered significant with respect to outdoor or indoor air exposure pathways.

3.1.2 Exposure Point Concentrations and Chemical Groups

Exposure point concentrations (EPCs) and general statistics are summarized in Table E1. EPCs are generally represented by a reasonable maximum exposure (RME) concentration, using the 95% upper confidence limit (95% UCL) on the arithmetic mean constituent concentration, as determined using the latest version of ProUCL (Version 5.0; USEPA, 2013). EPCs for notable constituents are described below.

<u>Mine Waste</u>

- Total Arsenic - ProUCL calculated an EPC of 20.79 using the 95% Kaplan Meier UCL. This EPC exceeds the RSL for arsenic in residential soil (0.07 mg/kg) as well as the local background range (up to 17 mg/kg; see Section 2.10).
- Total Cobalt – ProUCL calculated an EPC of 36.78 using the 95%-H UCL. This EPC exceeds the RSL for cobalt in residential soil (23 mg/kg).

- Total Lead – ProUCL calculated an EPC of 313.6 using the 95% Chebyshev UCL. This EPC exceeds a benchmark for lead in residential soil (80 mg/kg) based on the LeadSpread 8 model (DTSC, 2011).
- Total Mercury – ProUCL calculated an EPC of 0.17 using the 95% Kaplan Meier UCL. This EPC is below the RSL for mercury in residential soil (9.4 mg/kg).
- Total Vanadium – ProUCL calculated an EPC of 84 mg/kg based on the Student's-t UCL. This EPC is below the RSL for vanadium in residential soil (390 mg/kg).

Development Area Soil

- Total Arsenic - ProUCL calculated an EPC of 13.3 mg/kg using the 95% Adjusted Gamma UCL. This EPC exceeds the RSL for arsenic in residential soil and is within the range of local background (up to 17 mg/kg; see Section 2.10).
- Total Lead – ProUCL calculated an EPC of 39.8 using the 95% KM Chebyshev UCL. The calculated EPC is below the RSL for lead in residential soil.
- Total Mercury - ProUCL calculated an EPC of 0.332 using the 95% Chebyshev UCL. The RSL for mercury in residential soil is 9.4 mg/kg.

Background Soil

Arsenic

Background soil arsenic data were obtained from local DTSC-approved sites as described in Section 2.10 and Appendix D. The arsenic background threshold value (BTV) is represented by the 95th percentile value (17 mg/kg) for the local background data set.

Lead and Mercury

Background soil lead and mercury data were obtained as a subset of the development area soil data, after statistical evaluation and removal of outliers. Statistical data are summarized in Table E2, and statistical data summaries (ProUCL 5.0; DTSC, 2013) are also presented in Appendix E.

Five soil lead values (140, 110, 100, 100 and 50 mg/kg) obtained from the development area near the mine waste piles are outliers based on Rosner's Outlier test. These values were culled from the background set, and the resulting population was 44, of which 40 were detections. The distribution of the culled data set is lognormal. The background lead data range from <3 to 34 mg/kg, the mean is 13.49, and the BTV is represented by the 95% upper prediction limit (UPL; 30 mg/kg).

Three soil mercury values (1.3, 1.0 and 0.7 mg/kg) obtained from the development area near the mine waste piles are outliers based on Rosner's Outlier test. These values were culled from the background set, and the resulting population was 46, of which 25 were detections. Pro-UCL detected no discernable distribution, although the data appear to follow lognormal distribution based on the quantile-quantile (QQ) plot (Appendix E). The background mercury data range from <0.1 to 0.17 mg/kg, the mean is 0.17, and the BTV is represented by the 95% UPL (0.30 mg/kg).

Other Metals

Background soil data for chromium, cobalt, copper, nickel, selenium, vanadium and zinc were obtained from the development area at locations away from the mine waste piles. The data are presented in Table 2. Statistical data are summarized in Table E2, and statistical data summaries (ProUCL 5.0; DTSC, 2013) are also presented in Appendix E.

Background data are not available for all metals; therefore, mine waste EPCs are conservatively used for development area soil when other data are not available.

3.1.3 Constituents of Potential Concern

Inorganic constituents of potential concern (COPCs) for mine waste are selected by comparison to background data pursuant to the methodology described by DTSC (1997). This comparison is summarized in Appendix E, Table E2. The following constituents have maximum detected values that exceed the corresponding BTV value, and therefore are considered COPCs: arsenic, chromium, cobalt, copper, lead, mercury, nickel, selenium and zinc. The following constituents are considered COPCs in the absence of background data: barium, beryllium, molybdenum and silver. The COPCs are included in the human health exposure assessment and risk characterization.

Exposure assessment and risk characterization are also performed for development area soil, using the COPCs identified above, excluding arsenic, which is within the local background range. For the purposes of comparison, exposure assessment and risk characterization for background arsenic is also performed.

3.1.4 Exposure Parameters

Residential Land Use

Exposure parameters for residential land use are adopted from the PEA Guidance Manual (DTSC, 1999) as updated by HERO HHRA Note No. 1 (DTSC, 2014a), pursuant to guidance presented in *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* (RAGS Part E, Supplemental Guidance for Dermal Risk Assessment; US EPA, OSWER 9285.7-02EP, 2004), *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (US EPA, OSWER 9355.4-24, 2002), and *Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil* (OEHHA, 2005).

- Child and adult exposure are considered.
- Exposure frequency is 350 days per year.
- Body weight is 15 kilograms (kg) for child and 80 kg for adult.
- The incidental soil ingestion rate is 200 milligrams per day (mg/day) for child and 100 mg/day for adult. Pica is not considered.
- The inhalation rate is 10 cubic meters per day (m^3/day) for child and 20 m^3/day for adult.
- Averaging time is 70 years for carcinogenic effects.
- Exposure duration for adults is 20 years. Averaging time for non-carcinogenic effects is equal to the exposure duration.
- Exposed skin surface area is 2,900 square centimeters (cm^2) for children and 6,032 cm^2 for adults.
- Dermal adherence factor is 0.2 milligrams per square centimeter (mg/cm^2) for children and 0.07 mg/cm^2 for adults.
- Particulate emission factor (PEF) is 1.36×10^9 cubic meters per kilogram (m^3/kg).

Construction

Exposure parameters for construction are adopted from HERO HHRA Note No. 1 (DTSC, 2014). Considering the quantity of mine waste (approximately 2,000 cubic yards and the expected duration of the cleanup (approximately one month), the default exposure duration (one year) used in this scenario is conservative.

- Adult exposure is considered.
- Exposure duration is one year.
- Exposure frequency is 250 days per year.
- Body weight is 80 kg.
- Incidental soil ingestion rate is 330 mg/day.
- Inhalation rate is 20 m^3/day for the eight-hour workday.
- Averaging time is 70 years for carcinogenic effects.
- Averaging time for non-carcinogenic effects is equal to the exposure duration.
- Exposed skin surface area is 6,032 cm^2.
- Dermal adherence factor is 0.08 mg/cm^2.
- PEF is 1.0 x 10^6 m^3/kg.

Routine Visitation

Routine visitation of the mine waste area is considered because the mine waste is to be consolidated at the Site in an open space area under land use controls, and the remainder of the Site is to support residential development. Exposure parameters for routine child visitation are outlined below.

- The visitor is a child age 6 to 16 years.
- The exposure duration is 10 years, 2 hours per day.
- The exposure frequency is 7 days per week, 50 weeks per year.
- The exposure frequency for soil dermal contact is one event per day.
- Incidental soil ingestion is 200 mg/day. Pica is not considered.
- Inhalation rate is 2.4 m^3/day for a child during the 2-hour site visitation.
- Averaging time is 10 years for non-carcinogenic and 70 years for carcinogenic.
- Average body weight for boys and girls, 6 to 16 years old is 41.5 kg (*Exposure Factors Handbook*, EPA, 1997, p. 7-10 and Table 7-3).
- Exposed skin surface area is 2,900 cm^2 (*HERO HHRA Note No. 1*, DTSC, 2014).
- Dermal adherence factor is 0.2 mg/cm^2 (*Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E,*

Supplemental Guidance for Dermal Risk Assessment), Final (U.S. EPA, OSWER 9285.7-02EP, July 2004).

- Particulate emission factor is 1.36 x 10^9 m^3/kg (*Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (U.S. EPA, OSWER 9355.4-24, December 2002).

3.1.5 Toxicity Values

Toxicity values and sources are presented in Table E2, updated pursuant to HERO HHRA Note No. 3 (DTSC, 2014).

3.1.6 Risk Characterization

Risk and hazard calculations are performed using the following equations, which are based on Figures 5 through 8 of DTSC's PEA Guidance Manual (1999). For residential land use, hazard is evaluated for child exposure. Calculations are summarized in Tables E3 through E8, and results are summarized in Table E9.

$$Risk_{soil} = SF_o \times C_s \times [((IR_{s,child} \times EF \times ED_{child} \times 10^{-6}\ kg/mg) / (BW_{child} \times AT \times 365\ days/yr)) + ((SA_{child} \times AF \times ABS \times EF_{child} \times ED_{child} \times 10^{-6}\ kg/mg) / (BW_{child} \times AT \times 365\ days/yr)) + ((IR_{s,adult} \times EF \times ED_{adult} \times 10^{-6}\ kg/mg)/(BW_{adult} \times AT \times 365\ days/yr)) + ((SA_{adult} \times AF \times ABS \times EF_{adult} \times ED_{adult} \times 10^{-6}\ kg/mg) / (BW_{adult} \times AT \times 365\ days/yr))]$$

$$Hazard_{soil} = (C_s / RfD_o) \times [((IR_s \times EF \times ED \times 10^{-6}\ kg/mg) / (BW \times AT \times 356\ days/yr)) + ((SA \times AF \times ABS \times EF \times ED \times 10^{-6}\ kg/mg) / (BW \times AT \times 365\ days/yr))]$$

$$Risk_{air} = SF_i \times C_a \times [((IR_{child} \times EF \times ED_{child}) / (BW_{child} \times AT \times 365\ days/yr)) + ((IR_{adult} \times EF \times ED_{adult}) / (BW_{adult} \times AT \times 365\ days/yr))]$$

$$Hazard_{air} = (C_a / RfD_i) \times (IR \times EF \times ED) / (BW \times AT \times 365\ days/yr)$$

Where:

ABS = absorption fraction of chemical from soil

AT = averaging time, years

AF = soil to skin adherence factor, mg/cm^2

BW = body weight, kg

C_a = concentration in air, mg/m^3 ($C_a = C_s$ / PEF)

C_s = concentration in soil, mg/kg

ED = exposure duration, years

EF = exposure frequency

PEF = particulate emission factor, m^3/kg

$Hazard_{air}$ = non-cancer chronic health hazard for air pathways

$Hazard_{soil}$ = non-cancer chronic health hazard for soil pathways

IR_a = inhalation rate, m^3/day

IR_s = incidental soil ingestion rate, mg/day

SA = exposed skin surface area, cm^2

SF_i = inhalation cancer slope factor, $(mg/kg\text{-}day)^{-1}$

SF_o = oral cancer slope factor, $(mg/kg\text{-}day)^{-1}$

RfD_i = inhalation reference dose, mg/kg-day

RfD_o = oral reference dose, mg/kg-day

$Risk_{air}$ = lifetime excess cancer risk for air pathways

$Risk_{soil}$ = lifetime excess cancer risk for soil pathways

Residential Land Use

Human health risk and hazard under a residential exposure scenario are characterized in Tables E4 and E5.

Considering the mine waste under this unrestricted land use scenario, the hazard index (HI) is 2.8 and the excess lifetime cancer risk (risk) is 3.0 E-04. Primary contributors to non-cancer health hazard are arsenic (hazard quotient [HQ] = 0.97) and cobalt (HQ = 1.6). Cancer risk is driven by arsenic (3.0 E-04).

Considering the development area soil, the HI is 0.77 and the risk is 4.7 E-08. The primary contributor to hazard is cobalt (HQ = 0.6). Arsenic is excluded because it occurs in development area soil within the local background range. Hazard and risk associated with background soil arsenic are 0.6 and 1.9 E-04, respectively, conservatively assuming that arsenic in soil is completely available for biological uptake.

Construction

Human health risk and hazard under a construction worker exposure scenario are characterized in Tables E6 and E7.

Considering the mine waste under the construction scenario, the HI is 6.8 and the risk is 1.2 E-05. Primary contributors to hazard are arsenic (HQ = 1.2), cobalt (HQ = 4.6) and nickel (HQ = 0.7). Cancer risk is driven by arsenic (8.9 E-06) and cobalt (3.2 E-06).

Considering the development area soil, the HI is 2.5 and the risk is 1.3 E-06. The primary contributor to hazard and risk is cobalt (HQ = 1.7, risk = 1.2 E-06.), resulting from an EPC (13.8 mg/kg; 95% Student's-t UCL) that is approximately half of the RSL (23 mg/kg) for cobalt in residential soil.

Arsenic is excluded from the development area risk characterization because it occurs in development area soil within the local background range. Hazard and risk associated with background soil arsenic under the construction scenario are 0.7 and 5.7 E-06, respectively, conservatively assuming that arsenic in soil is completely available for biological uptake.

Routine Visitation

Human health risk and hazard for mine waste under a routine visitation exposure scenario is characterized in Table E8. The HI is 1.0 and the risk is 1.4 E-04. Primary contributors to hazard are arsenic (HQ = 0.3) and cobalt (HQ = 0.6). Cancer risk is driven by arsenic (1.4 E-04).

3.1.7 Lead Hazard Assessment

Lead hazards were assessed using the *Lead Risk Assessment Spreadsheet Version 8* (LeadSpread 8; DTSC, 2011) for child exposure, and the Modified USEPA Adult Lead Model (Modified ALM; DTSC, 2011) for adult exposure. Calculations were performed using standard exposure parameters and the EPC values (95% UCL values) listed in Table E1. Results are summarized in Table E11. LeadSpread output is presented in Appendix E.

The California Environmental Protection Agency (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA) revised toxicity evaluation procedures for lead in 2007, replacing the 10 µg/dL threshold blood concentration with a source-specific "benchmark change" of 1 µg/dL. This change is addressed in the OEHHA publication *Child-Specific Benchmark Change in Blood Lead Concentration for School Site Risk Assessment* (OEHHA, April 2007; http://oehha.ca.gov/public_info/public/kids/pdf/PbHGV041307.pdf).

For development area soil, the EPC is 39.8 mg/kg (95% Chebyshev UCL), the 90th percentile estimate of child blood lead is 0.5 micrograms per deciliter (ug/dl), and the adult worker blood lead level is 0.1 ug/dl.

For mine waste, the EPC is 313.8 mg/kg (95% Chebyshev UCL), the 90th percentile estimate of adult worker blood lead is 4.1 micrograms per deciliter (ug/dl), and the adult worker blood lead level is 0.5 ug/dl.

The proposed remedial action (see Section 7 and Figure 4) includes deep burial of mine waste with the highest lead concentrations (detected at the New Shaft location, sample location T-22) at a depth greater than ten feet bgs under engineered fill. The remaining mine waste, which is to be buried at shallower depths (1 to 10 feet bgs) has a lower lead EPC (79.0 mg/kg; 95% Adjusted Gamma UCL), derived as shown in Table 10. ProUCL output for the derivation is presented in Appendix E. Child and adult assessment for lead in mine waste that is to be buried at depths less than ten feet bgs does not result in unacceptable lead exposure values.

3.1.8 Uncertainty Analysis

Per OEHHA (2004), "systematic, logical and informed approaches to decision making about carcinogens in the environment call for quantitative assessments, because the absence of clearly definable thresholds does not permit identification of 'safe' levels of exposure. Unfortunately, due to the frequent lack of sufficient data, assumptions have to be made in order to complete quantitative assessments of cancer risk."

There are uncertainties associated with metals content of waste and affected soil, the amount of exposure to waste and soil; the biological uptake of metals from waste and soil; and the toxicological effects of biologically available metals. Such uncertainty must be discussed so that the assessment does not result in a "higher degree of implied certainty in the overall assessment than is warranted" (OEHHA, 2004).

As a result of the uncertainties described below, confidence in the exposure assessment is considered low to moderate. Confidence in toxicity values ranges from low to high based on the data available for specific metals. The risk assessment considers routine exposure to waste that is to be consolidated as engineered fill in open space, vegetated and posted. This assessment conservatively assumes that soil arsenic is entirely bioavailable, which is typically not the case based on previous assessment of other local sites.

Sampling Uncertainty

Sampling uncertainty related to contaminant concentration in soil, as well as sampling uncertainty related to the literature-derived exposure and toxicity parameters, contribute to the overall uncertainty of the assessment. Statistical analysis is performed as part of the assessment to develop a reasonable maximum exposure level. Confidence in a population mean and variance increases as the number of samples taken from the population increases. Confidence in sampling is considered moderate.

Model Uncertainty

The literature-derived exposure factors and toxicity factors used in the assessment were obtained with the goal of reducing uncertainty; however, limitations of existing data pertaining to activity patterns for future site occupants, as well as health effects from metals exposure, result in model uncertainty.

Bioavailability

The assessment assumes that arsenic in soil is completely available for biological uptake. Unpublished studies of other abandoned mine lands in Nevada County indicate that the actual bioavailability of arsenic is typically lower than 20 percent. The assumption of 100 percent bioavailability likely overestimates the health effects presented by waste and affected soil at the site.

Laboratory Methods and Detection Limits

Except for antimony, cadmium and thallium, the soil metals concentrations generally exceed the corresponding laboratory detection limits. Therefore, detection limits are not expected to be a significant source of uncertainty.

Toxicity Values

The cancer slope factors imply a linear (no threshold) dose-response relationship; however, others have postulated a non-linear relationship, and the mechanisms for arsenic carcinogenicity are not known (OEHHA, 2004). If the dose-response relationship is non-linear, the assumption of linearity would tend to overestimate risks.

3.1.9 Summary of Risk Assessment Findings

As presented in Table E10, the mine waste is not acceptable for unrestricted land use (HI = 2.8, risk = 3E-04), and soil management procedures are required to control worker exposure under the construction scenario (HI = 6.8, risk = 1E-05).

Evaluation of the routine child visitation scenario (HI = 1.0, risk = 1E-04) indicates that remedial action should include clean soil cover of the consolidated mine waste placement area. In general, arsenic and cobalt concentrations are primary contributors to chronic human health hazard and excess lifetime cancer risk.

Arsenic is present within the development area soil at levels within the local background range. Excluding arsenic from the risk characterization results a hazard (HI=0.8) and risk (5E-08) that are below the corresponding benchmarks of 1.0 and one-per-million, respectively.

Cobalt in the development area soil drives hazard and risk for the construction worker exposure scenario (HQ = 1.7, risk = 1.2 E-06). However, the cobalt EPC (13.8 mg/kg; 95% Student's-t UCL) is considered to be in the background range and is approximately half of the RSL (23 mg/kg) for cobalt in residential soil. In addition, the exposure duration for the construction scenario is conservatively assumed to be one year, whereas the actual duration of earthwork construction at the 15-acre Site will likely be no longer than three months.

As presented in Table E11, lead hazard assessment indicates that the mine waste is not acceptable for unrestricted land use. The EPC (313 mg/kg) for lead in mine waste is based on a 95% UCL for all mine waste lead values.

The proposed remedial action (see Section 7 and Figure 4) includes deep burial of mine waste with the highest lead concentrations (detected at the New Shaft location, sample location T-22) at a depth greater than ten feet bgs under engineered fill. The remaining mine waste, which is to be buried at shallower depths (1 to 10 feet bgs) has an EPC (79.0 mg/kg; 95% Adjusted Gamma UCL) that does not result in unacceptable exposure values using the child or adult model.

3.2 ECOLOGICAL RISK ASSESSMENT

An ecological scoping assessment was performed in general accordance with guidelines set forth in DTSC's Ecological Scoping Assessment (ESA) guidance (available online at http://www.dtsc.ca.gov/assessingrisk/eco2.cfm).

Scoping-level assessment is described in *Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities, Part A: Overview* (DTSC, 1996). An ESA is the first phase of assessment, and is intended to develop a conceptual site model, identify contaminants and receptors of concern and potential exposure pathways.

A scoping-level assessment consists of a chemical, physical, and biological characterization of the Site, and an evaluation of the potential for complete exposure pathways. The results of this qualitative assessment may be used to determine the need for and the extent of further assessment. Components of the ESA include:

- Site characterization;
- Biological characterization; and
- Pathway assessment.

Because the scoping-level assessment identified potentially complete exposure pathways for ecological receptors, EPCs were compared to ecological screening benchmarks, and the potential for ecological exposure was evaluated in the context of the proposed remedial action, as described below.

3.2.1 Site Characterization

Site characterization findings are presented in Section 2 of this RAW and are summarized below.

<u>Mine Waste Locations</u>

Site investigation identified mine waste at three locations (Crosby, Williams and New Shaft). The locations are depicted on Figure 2 and as follows.

Mine Waste Locations

Location	**Description**	**Mine Waste Volume** (cubic yards)	**Area** (acres)
Crosby	Stockpile to be removed and placed at New Shaft location	1,360	0.25
Williams	Stockpile to be removed and placed at New Shaft location	350	0.07
New Shaft	Mine waste to remain in place (this is the proposed waste placement area)	790	0.32
Proposed waste placement area at New Shaft location	Mine waste from the three AOCs is to be placed at the New Shaft location as engineered fill under land use controls	2,500	0.32

Constituents of Potential Ecological Concern

Metals data for mine waste and background soil are presented in Tables 1 and 2. Table E12 (Appendix E) presents summary statistics for and EPCs for inorganic constituents in mine waste. Constituents of potential ecological concern (COPECs) are selected based on comparison to background concentrations and soil screening levels, as presented in Table E13. Background arsenic data are presented in Section 2.10 and Appendix D. COPECs are summarized below.

Cobalt

Cobalt is identified as a COPEC because the EPC for cobalt in mine waste (36.8 mg/kg; 95% H-UCL) exceeds the range of Site background concentrations and exceeds the Eco-SSL for plants (13 mg/kg).

Copper

Copper is identified as a COPEC because the EPC for copper in mine waste (115.6 mg/kg; 95% Student's-t UCL) exceeds the range of Site background concentrations and exceeds the Eco-SSLs for plants (70 mg/kg), soil invertebrates (880 mg/kg), avian wildlife (28 mg/kg) and mammalian wildlife (49 mg/kg).

Lead

Lead is identified as a COPEC because the EPC for lead in mine waste (313.6 mg/kg; 95% Chebyshev UCL) exceeds the range of Site background concentrations and exceeds the Eco-SSLs (USEPA, 2005, 2008) for plants (120 mg/kg), avian wildlife (11 mg/kg) and mammalian wildlife (56 mg/kg).

The proposed remedial action (see Section 7 and Figure 4) includes deep burial of mine waste with the highest lead concentrations (detected at the New Shaft location, sample location T-22) at a depth greater than ten feet bgs under engineered fill. The remaining mine waste, which is to be buried at shallower depths (1 to 10 feet bgs) has a lower lead EPC (79.0 mg/kg; 95% Adjusted Gamma UCL), derived as shown in Table 9. ProUCL output for the derivation is presented in Appendix E. The EPC for lead in shallow mine waste exceeds the Eco-SSLs for avian (11 mg/kg) and mammalian (56 mg/kg) wildlife.

Nickel

Nickel is identified as a COPEC because the EPC for nickel in mine waste (16.86 mg/kg; Student's-t UCL) exceeds the range of Site background concentrations and exceeds the Eco-SSLs for avian wildlife (4.2 mg/kg) and mammalian wildlife (14 mg/kg).

Selenium

Selenium is identified as a COPEC because the EPC for selenium in mine waste (1.4 mg/kg; maximum detected value) exceeds the range of Site background concentrations (selenium was not detected in background soil) and exceeds the Eco-SSLs for plants (0.52 mg/kg), avian wildlife (1.2 mg/kg) and mammalian wildlife (0.63 mg/kg). Selenium was detected in only two of fourteen mine waste samples analyzed for selenium. Therefore, use of the maximum detected value is considered conservative, and the actual EPC is likely to be significantly lower.

Zinc

Zinc is identified as a COPEC because the EPC for zinc in mine waste (71.2 mg/kg; Student's-t UCL) exceeds the range of Site background concentrations and exceeds the Eco-SSLs for avian wildlife (46 mg/kg).

3.2.2 Biological Characterization

Typical receptors were identified in relation to the identified habitats and were confirmed by Site-specific observation (Costella, 2010). A biological inventory and wetlands delineation map (Costella, 2010) are presented in Appendix I.

Habitats

The Site is located within the Sierra Nevada Foothills ecological subregion of California, which transitions into the Sierra Nevada subregion east of the Site. The California Wildlife Habitat Relationship System (Mayer and Laudenslayer, 1988) characterizes the region primarily as montane hardwood, montane hardwood-conifer habitats, with stands of closed-cone pine-cypress habitat also occurring in the general area.

Costella (2010) describes Western Ponderosa Pine Forest habitat and non-native annual grasses and forbs within the Site, as well as ephemeral drainages and wetland areas. The mine waste is not located within mapped drainages or wetlands.

Species and Communities

Native and introduced flora identified at the Site are presented in Appendix A of the biological inventory report (Costella, 2010). Dominant species in the montane hardwood and montane hardwood-conifer forest habitats include canyon live oak, black oak and Douglas fir, and also include big-leaf maple, Pacific madrone, dogwood, incense cedar, and ponderosa pine. Coniferous constituents include varying mixtures of Douglas fir, ponderosa pine, incense cedar, Coulter pine, Jeffrey pine, sugar pine, black oak, and canyon live oak.

Common foothill/mountain species include scrub and Stellar's jays, acorn woodpecker, and western gray squirrel. Upland game birds include wild turkey, mountain and California quail, and band-tailed pigeon. Raptors common to the foothill/mountain area include red-tailed hawk, turkey vulture, Cooper's and sharp-shinned hawks, while California spotted owls are known to be present amidst the broader regional area. Rodents and related small mammals include deer mice, woodrat, gophers, and squirrel. Typical larger mammals include mule deer, black bear, coyote, gray fox, and bobcat. This preliminary list of potential representative species was confirmed by site-specific observation (Costella, 2010). Wildlife identified at the Site are listed in Appendix B of the biological inventory report (Costella, 2010).

Special Status Species

No special status species were observed during the surveys performed by Costella (2010). Special status plants and wildlife known to occur in the vicinity (the Nevada City quadrangle) are listed in Appendices C and D, respectively, of the biological inventory report (Costella, 2010). Costella (2010) identifies special status plant species that have the potential to occur at the Site based on the observed habitat types, including Brandegee's Clarkia (Clarkia biloba ssp. brandegeeae) and Butte County Fritillary (Fritillaria eastwoodiae). These species were not identified during the surveys.

3.2.3 Pathway Assessment

Terrestrial receptors are currently exposed to elevated metals concentrations in mine waste (naturally mineralized soil and rock) at the Crosby, Williams and New Shaft locations. A site conceptual model diagram is presented as Figure 6. The contaminated medium at the site is soil (naturally mineralized mine waste at upland locations), and the potential for water quality impact is not significant. Potentially complete exposure pathways include:

- Direct exposure to contaminated soil for producers and invertebrates;
- Indirect exposure for consumers via food-web transfer (ingestion of affected biota); and
- Secondary direct exposure for consumers (incidental soil ingestion, inhalation of soil dust and dermal contact).

Terrestrial plants may be exposed via root contact, and herbivorous consumers may consume the contaminants with the affected plants. Terrestrial invertebrates may incorporate contaminants by contact with contaminated soil. Wildlife exposure may occur via food-web transfer or directly via inhalation of soil dust or incidental ingestion during activities such as foraging, grooming or burrowing. Mercury is the only constituent that is potentially volatile, and the mercury concentrations detected at the Site indicate that mercury volatilization is not significant.

Wildlife exposures to chemicals in soil via inhalation of volatile constituents or dust and dermal contact are not evaluated quantitatively in this ESA, pursuant to the ecological soil-screening level (Eco-SSL) guidance (USEPA, 2005).

3.2.4 Findings of Ecological Screening Assessment

The screening assessment identified COPECs (cobalt, copper, lead, nickel, selenium, zinc) in mine waste because these constituents occur in mine waste (mineralized soil and rock) at concentrations higher then Site background concentrations. Constituent concentrations for nickel, selenium and zinc do not exceed typical published soil background values, as summarized below.

Comparison to Published Background Values[1]

Constituent	Site EPC	LBL[1]		Dragun[2]
		95th Percentile	99th Percentile	Typical Range
Nickel	16.9	164	272	5.0 - 1,000
Selenium	1.4	not listed	4.9	0.1 – 2.0
Zinc	71.2	110	140	10 - 300

1 Diamond, D. et al., 2009. Analysis of Background Distribution of Metals in Soil at the Lawrence Berkeley National Laboratory. April. Table 4.

2 Dragun, J., 1988. The Soil Chemistry of Hazardous Materials. Hazardous Materials Control Research Institute. Silver Spring, Maryland. Table 3.1.

Cobalt, copper and lead are present in mine waste above typical published background values. The metals occur naturally in the mine waste as a result of hydrothermal alteration of bedrock and subsequent weathering processes. Such hydrothermal alteration often occurs along gold-bearing veins formed in bedrock fractures. Past mining activities resulted in stockpiles of mine waste (soil and rock) at the Crosby, Williams and New Shaft locations.

Burial of the mine waste and cover with clean soil is intended to limit the potential for ecological exposure. As described in Section 7 of this RAW, an estimated 1,710 cubic yards of mine waste (soil and rock) are to be excavated from the Crosby and Williams locations and placed as engineered fill at the New Shaft location. The proposed mine waste placement area at the New Shaft location measures 14,000 square feet (0.32 acres) and will contain an estimated 2,500 cubic yards of mine waste. A grading plan is presented as Figure 4. The mine waste is to be covered with one foot of clean soil; drainage and erosion controls are to be installed; and the area is to be posted and deed-restricted to prevent future unauthorized excavation.

Potentially complete exposure pathways exist for burrowing terrestrial receptors. The following factors will tend to limit ecological exposure to burrowing receptors:

- The mine waste is to be covered with at least one foot of compacted soil.
- The mine waste itself will be compacted to a minimum of 90% of the ASTM D1557 maximum dry density.
- The total lead concentrations within ten feet of the ground surface are moderate (lead 95% UCL = 79 mg/kg), while the EcoSSL for mammalian wildlife is 56 mg/kg.
- The mine waste is net acid-neutralizing, sulfate content is low, and lead solubility is low (see Section 3.3 of this RAW).

3.3 EVALUATION OF RISK TO WATER QUALITY

The regulatory framework governing the protection of water quality is described in the *Policy for Implementation of Toxic Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California*, also known as the State Implementation Policy (SWRCB, 2005). Pursuant to state and federal regulation, the following water quality objectives and criteria are potentially applicable. The water quality objectives described above are listed in Table 6.

1. Federal water quality criteria set forth in the National Toxics Rule (NTR; USEPA 1995) and in the California Toxics Rule (CTR; USEPA 2000), which is promulgated by the USEPA in 40 CFR 131.38.
2. Water quality objectives from the *Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins* established by the California Regional Water Quality Control Board, Central Valley Region (Regional Water Board, 1998), including Maximum Contaminant Levels

(MCLs) specified in Title 22 of the California Code of Regulations (22 CCR), which are incorporated by reference into the Basin Plan.

3. USEPA ambient water quality recommended criteria and other criteria commonly used by the Regional Water Board to interpret narrative objectives in the Basin Plan, such as Office of Environmental Health Hazard Assessment (OEHHA) fish consumption benchmarks, federal and state antidegradation requirements, and waterway-specific benchmarks.

When federal standards appear to be over-protective or under-protective of the designated uses for a specific water body, the Regional Water Board may develop site-specific water quality criteria. The CWA 303(d) list of impaired water bodies contains such site-specific water quality criteria. Deer Creek has been placed on the CWA Section 303(d) list by the State Water Resources Control Board (SWRCB, 2015) as impaired for mercury. Pursuant to the 303(d) listing, waterway-specific Total Maximum Daily Load (TMDL) limitations are expected to be developed by 2016. The South Fork Yuba River (Spaulding Reservoir to Englebright Reservoir) is listed as impaired for mercury and temperature, and TMDL limitations are expected by 2021.

According to the Basin Plan, California water bodies must be protected against water quality degradation for the most restrictive beneficial use. The Designated Level Methodology for Waste Classification and Cleanup Level Determination (DLM; RWQCB, 1989) outlines a process for evaluating site specific conditions to determine whether a threat is posed to surface water or groundwater quality from soluble contaminants, and allows for the assumption of attenuation of contaminant concentrations between the contaminant source and groundwater/surface water receptors, provided that specific parameters and assumptions are defined.

3.3.1 Soluble Constituents

Total lead concentrations detected in samples TC-22A, TC-22B, and TC-22C exceeded ten times the Soluble Threshold Limit Concentration (STLC); therefore, extraction testing was performed for lead using deionized water as the extractant solution (DI-WET). Deionized water was selected based on the ABA results, pursuant to the Designated Level Methodology (RWQCB, 1989). Soluble lead concentrations ranged from 0.3 ug/L to 1.2 ug/L. The maximum detected soluble lead concentration is used in this evaluation.

3.3.2 Surface Water Receptors

The Site is drained by Peck Ravine, an ephemeral drainage course that enters Deer Creek approximately 1,200 feet northwest of the Site. The Basin Plan does not specifically identify beneficial uses and water quality objectives for Deer Creek. However, the beneficial uses of any water body that is specifically identified in the Basin Plan generally apply to its tributary streams (CRWQCB, 1998, page II-2.00). The Basin Plan identifies the following existing and potential beneficial uses for the Yuba River above Englebright Reservoir:

- Municipal and domestic supply;
- Agricultural water supply;
- Hydropower generation;
- Water contact and non-contact recreation;
- Cold freshwater habitat;
- Spawning, reproduction and/or early development of fish; and
- Wildlife habitat.

Although these beneficial uses do not necessarily apply to the Deer Creek drainage, the corresponding water quality objectives would typically be used as the basis for a conservative comparison:

- Maximum Contaminant Level (MCL) values for drinking water;
- California Toxics Rule (CTR) values for protection of human health and aquatic life; and
- Agricultural (Ag) water quality objectives set forth in the Basin Plan.

Laboratory test methods and detection limits are set forth in the Regional Water Board's *Tech Note, Mining Waste Characterization* (RWQCB, 2008), and are based on the criterion quantitation limits pursuant to the State Implementation Policy.

3.3.3 Groundwater Receptors

H&K reviewed groundwater well completion reports provided by the California Department of Water Resources (DWR) for properties within a 2000-foot radius of the Site boundaries. Table 5 lists the well locations, geologic logs, depths to first encountered groundwater, depths to static groundwater, and well completion data.

According to the well completion reports provided by DWR, at least 15 domestic wells are located within the search radius. The closest identified well is located on a property approximately 1,890 feet to the east of the Site. The total depths of the wells were 125 feet and 900 feet. Depth to first water in the wells ranged from 43 to 390 feet. The Site is lower in elevation than the wells identified to the west, south, and east. The Site is at equal and higher elevation then wells identified to the north and northwest. However, the wells identified to the north and northwest are on the opposite side of Deer Creek.

3.3.4 Attenuation Factors and Soluble Designated Levels

Table 6 presents attenuation factors and soluble designated levels (SDLs) for surface water and groundwater.

Rationale for selecting the simplified environmental attenuation factor for surface water is based on review of the characteristics listed for surface water in Figure 10 of the DLM. An environmental attenuation factor of 100 is selected for assessing surface water conditions. The mine waste placement area is to be protected from storm water runoff and is to be located approximately 1,200 feet away from Deer Creek. The metals of concern are not volatile or degradable, and are generally not subject to other waste constituents that could affect their mobility.

Rationale for selecting the simplified attenuation factor for groundwater is based on review of the characteristics listed for groundwater in Figure 10 of the DLM, and consideration of the topography of the proposed waste placement area. An environmental attenuation factor of 100 is selected for assessing groundwater conditions. Groundwater was not encountered in the four exploratory borings drilled at the Site to depths of up to 35 feet bgs as part of the geotechnical engineering investigation (H&K, 2014B). ABA results indicate that the mine waste has low acid generation potential, low sulfur content and relatively neutral pH, indicating that the long-term acid generation potential is low. Sensitive groundwater receptors were not identified within 1,800 feet of the Site.

3.3.5 Summary of Evaluation

DI-WET laboratory analysis of mine waste identified soluble lead at concentrations up to 1.2 ug/L. This concentration is lower than the SDL for lead (9.2 ug/L; Table 6) based on the lowest applicable water quality objective (CTR) and an environmental attenuation factor of 100 for surface water and groundwater. The findings presented herein indicate that the potential for acid generation is low and the potential for discharge or leaching of heavy metals at concentrations that would significantly impact surface water or groundwater quality is low. Therefore, the mine waste may be considered Group C (inert) waste as defined in CCR Title 27 Section 2248(b).

4 REMEDIAL ACTION OBJECTIVES

4.1 OVERVIEW

This section establishes remedial action objectives (RAOs) pursuant to 40 CFR 300.430. The RAOs are intended to specify contaminants and media of concern, potential exposure pathways, and remediation goals. The remediation goals are acceptable exposure levels that are protective of human health and the environment and do not conflict with applicable, relevant and appropriate requirements (ARARs) under federal and state environmental law.

For known or suspected carcinogens, acceptable exposure levels are generally concentrations that represent an excess upper bound lifetime cancer risk to an individual of between one in ten thousand and one in one million, using information on the relationship between dose and response. For systemic toxicants, remediation goals generally represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety.

Remediation goals must also consider factors related to technical limitations such as metals concentrations in ambient soil, detection/quantification limits for contaminants, factors related to uncertainty, and other pertinent information.

4.2 ARARs

The NCP requires compliance with ARARs during remedial actions to the extent practicable. ARARs include federal, state, and local environmental laws, regulations, and standards that can be chemical-specific, location-specific, or action specific. Chemical-specific ARARs are health-based or environmentally-based numerical limits pertaining to the amount of a contaminant released to the environment or allowed to remain in the environment as a result of the proposed remedial activity. Location-specific ARARs may restrict remedial action if the proposed action is located in an environmentally sensitive or historically significant area. Action-specific ARARs may restrict remedial action based on the specific remedial action and/or byproducts of the remedial action.

4.2.1 Chemical-Specific ARARs

Resource Conservation and Recovery Act (RCRA)

RCRA Subtitle C, contained in 40 CFR, pertains to the characterization of hazardous waste. The Site investigation findings indicate that the mine waste (naturally mineralized soil and rock) is not classified as hazardous waste with respect to the constituents analyzed. Therefore, RCRA Subtitle C is not considered to be applicable.

California Code of Regulations (CCR) Title 22

Section 66261 of CCR Title 22 pertains to the characterization of hazardous waste. The Site investigation findings indicate that the mine waste (naturally mineralized soil and rock) is not classified as hazardous waste with respect to the constituents analyzed. Therefore, this section of CCR Title 22 is not considered to be applicable.

Regional Screening Levels (RSLs)

RSLs established by USEPA Region 9 (as modified by Cal/EPA in the case of beryllium, cadmium and lead) are applicable to the proposed soil management activities as a screening tool. Concentrations of arsenic lead and cobalt in some samples exceed the corresponding RSLs for these metals in residential soil. The management of arsenic in soil is typically based on background concentrations because background soil arsenic concentrations commonly exceed the RSL for arsenic in residential soil.

California Water Code

Division 7 of the California Water Code establishes priorities for the Regional Water Board. Regional Water Board guidance and numerical limits are presented in various documents. The *Basin Plan* (RWQCB, 1998), *Designated Level Methodology for Waste Classification and Cleanup Level Determination* (RWQCB, 1989), Antidegradation Policy (SWRCB, 1968), and *A Compilation of Water Quality Goals* (RWQCB, 2015, as amended) establish policies, procedures and numerical limits for protection of surface water and groundwater quality. As presented in Section 3, the potential for water quality impact is considered to be low because the metals are relatively immobile in soil and best management practices for erosion control are to be implemented during the remedial action.

4.2.2 Location-Specific ARARs

National Historic Preservation Act

The National Historic Preservation Act, as set forth in Sections 65 and 800 of CFR Title 36, pertains to cultural resources and historic sites. The proposed remedial action is subject to CEQA review as part of the proposed development project, and is not expected to result in the disturbance of significant cultural resources or historic sites. The proposed remedial action will comply with the National Historic

Preservation Act and will be performed in a manner that will not disturb significant cultural resources or historic sites.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act, as set forth in Section 6.302 of CFR Title 40, pertains in part to wetlands protection and flood management. As wetlands or flood-prone areas have not been identified at the proposed remedial action areas, this regulation is not considered to be applicable.

Clean Water Act

The Clean Water Act, as set forth in Section 230 of CFR Title 40, pertains to flood-prone areas and wetlands. As such areas have not been identified at the remedial action areas, this regulation is not considered to be applicable. H&K understands that the construction project, and thus the remedial action, has been designed with consideration of these regulations.

4.2.3 Action-Specific ARARs

Air Resources Board Regulation 93105

Under California law, disturbance of soil and rock that contains ultramafic rock, serpentinite or naturally occurring asbestos (NOA) minerals must be handled as described in Cal/EPA Air Resources Board Regulation 93105, *Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations*. Based on the geology of the site, NOA is not expected at the Site. This RAW includes a dust control plan.

California Water Code

The California Water Code governs the characterization of waste for disposal to land. Waste disposal must comply with the provisions of the California Water Code.

Nevada County Land Use and Development Code

Pursuant to the Nevada County Land Use and Development Code, a grading permit is required for earthwork associated with the proposed residential development. A grading permit is to be obtained from the County of Nevada as part of the development process.

Northern Sierra Air Quality Management District Rule 226

Northern Sierra Air Quality Management District Rule 226 requires that a dust control plan be prepared for construction activity disturbing over one acre of land. Rule 226 is applicable and is addressed by the appended Dust Mitigation Plan.

Public Resources Code 4581 and 4621

The proposed remedial action is not expected to include significant timber operations that involve the removal of conifers. A “significant” timber operation is generally considered to involve the disturbance of more than 2.99 acres of timberland. A Timber Harvesting Plan (THP; Public Resources Code 4581) and a Timberland Conversion Permit (TCP; Public Resources Code 4621) are not expected to be required for the proposed remedial activities.

National Pollutant Discharge Elimination System

Pursuant to the National Pollutant Discharge Elimination System (NPDES), coverage under the Construction General Permit (Order No. 2009-0009-DWQ) issued by the State Water Resources Control Board (SWRCB) must be obtained to address discharges of storm water runoff form construction projects that encompass one acre or more in total acreage of soil disturbance. Accordingly, a Notice of Intent (NOI) must be submitted and a permit fee must be paid, and a Storm Water Pollution Prevention Plan (SWPPP) must be prepared to address storm water Best Management Practices (BMPs) for erosion control, sediment retention and waste management.

4.3 MEDIA AND CONSTITUENTS OF CONCERN

The medium of concern at the site is soil, and the constituents of potential concern (COPCs) are naturally-occurring metals (including arsenic, lead and cobalt). Potential exposure pathways include dermal absorption through direct contact, incidental ingestion, and inhalation of soil dust.

The primary medium of concern at the site is soil. Potential exposure pathways are associated with soil and include dermal absorption through direct contact, incidental ingestion, and inhalation of soil dust. Elevated lead concentrations are present in soil at the New Shaft location (up to 920 mg/kg), the Williams location (up to 300 mg/kg), and the Crosby location (up to 73 mg/kg). Arsenic was detected at concentrations up to 29 mg/kg at the New Shaft location, up to 37 mg/kg at the Williams location, and up to 34 mg/kg the Crosby location.

4.4 QUANTITY ESTIMATE

KPFF Consulting Engineers estimates that 1,710 cubic yards of soil will be excavated from the Williams and Crosby locations and transported to the New Shaft location. This volume estimate includes an estimated 350 cubic yards of soil from the Williams location and an estimated 1,360 cubic yards of soil from the Crosby location. The locations are depicted on Figure 2, and a grading plan for the New Shaft placement area is presented as Figure 4.

4.5 REMEDIAL ACTION GOALS

The goal of the remedial action is to excavate the mine waste from the Crosby and Williams locations, verify that the underlying soil is acceptable for unrestricted land use, and consolidate the mine waste in open space at the New Shaft location in accordance with the following restrictions:

- Covered with at least one foot of clean soil;
- Outside of areas that are to contain underground utilities;
- Outside of areas that may contact groundwater or surface water;
- At locations that are protected from erosion; and
- Above the highest groundwater elevation.

The goal of the remedial action is to reduce to acceptable levels the potential human health risk and water quality impact associated with the naturally mineralized mine waste. Target cleanup levels are presented in Table 7 and are summarized below.

4.5.1 Remedial Action Goals for Unrestricted Land Use

Numerical cleanup goals are presented in Table 7 and are summarized below.

<u>Total Arsenic in Soil</u>

The target cleanup level for arsenic is based on an evaluation of local background soil arsenic concentrations, as summarized in Section 2.10 and Appendix D. The 95th percentile value for the local background arsenic data set is 17 mg/kg. This value is considered a background threshold value (BTV) representing local background soil arsenic concentrations. The 95% upper confidence limit (UCL) goal for arsenic in soil verification samples is 13.3 mg/kg.

<u>Total Cobalt in Soil</u>

The target cleanup level for cobalt is based on Site background. The BTV is 15.0 mg/kg and the UCL goal is 13.8 mg/kg.

Total Copper in Soil

The target cleanup level for copper is based on Site background. The BTV is 75.8 mg/kg and the UCL goal is 58.6 mg/kg.

Total Lead in Soil

The target cleanup level for lead is 140 mg/kg, and the UCL goal is 80 mg/kg. The lead cleanup goal is based on statistical evaluation of Site soil lead data, considering the maximum soil lead concentration in a distribution whose 95% upper confidence limit (UCL) of the arithmetic mean soil lead concentration is less than or equal to 80 mg/kg. The cleanup goal is expected to be health-protective when exposure is averaged site-wide.

Statistical evaluation of soil lead concentrations was performed using ProUCL Version 5.0 statistical software for environmental applications (USEPA Publication EPA/600/R-07/041, September 2013). The target central tendency value (80 mg/kg) for soil lead is based on an evaluation of lead in soil using Lead Risk Assessment Spreadsheet Version 8 (DTSC; http://www.dtsc.ca.gov/AssessingRisk/leadspread8.cfm).

Site lead data are sorted and culled as shown in Table 8. After culling the three highest Site lead values, the resulting 95% KM (Chebyshev) UCL is 41.6 mg/kg. ProUCL output is presented in Appendix E.

Total Nickel in Soil

The target cleanup level for nickel is based on Site background. The BTV is 12.0 mg/kg and the UCL goal is 10.3 mg/kg.

Total Selenium in Soil

The target cleanup level for selenium is based on Site background, based on the laboratory reporting limit (1.0 mg/kg).

Total Zinc in Soil

The target cleanup level for zinc is based on Site background. The BTV is 36.1 mg/kg and the UCL goal is 29.2 mg/kg.

5 EVALUATION OF REMEDIAL ACTION ALTERNATIVES

This RAW is intended to serve as the equivalent of an EE/CA, pursuant to the NCP. Remedial alternatives are evaluated based on effectiveness, implementability, and cost. The alternatives included (1) No Action, (2) Excavation and On-Site Placement, and (3) Excavation and Off-Site Disposal.

5.1 OVERVIEW

Pursuant to 40 CFR Part 300.430, as determined appropriate and to the extent sufficient information is available, the short-term and long-term aspects of the following three criteria are to be used to guide the development and screening of remedial alternatives:

Effectiveness. This criterion focuses on the degree to which an alternative reduces toxicity, mobility, or volume through treatment, minimizes residual risks and affords long-term protection, complies with ARARs, minimizes short-term impacts, and how quickly it achieves protection. Alternatives providing significantly less effectiveness than other, more promising alternatives are eliminated. Alternatives that do not provide adequate protection of human health and the environment are also eliminated from further consideration.

Implementability. This criterion focuses on the technical feasibility and availability of the technologies each alternative would employ and the administrative feasibility of implementing the alternative. Alternatives that are technically or administratively infeasible or that would require equipment, specialists, or facilities that are not available within a reasonable period of time are eliminated from further consideration.

Cost. The costs of construction and any long-term costs to operate and maintain the alternatives are to be considered. Costs that are grossly excessive compared to the overall effectiveness of alternatives are considered as one of several factors used to eliminate alternatives. Alternatives providing effectiveness and implementability similar to that of another alternative by employing a similar method of treatment or engineering control, but at greater cost, may be eliminated.

The analysis of alternatives under review reflects the scope and complexity of site problems and alternatives being evaluated, and considers the relative significance of the factors within each of the following criteria:

Overall protection of human health and the environment. Alternatives are assessed to determine whether they can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Compliance with ARARs. The alternatives are assessed to determine whether they attain applicable or relevant and appropriate requirements under federal environmental laws and state environmental or facility citing laws or provide grounds for invoking waivers from such laws.

Long-term effectiveness and permanence. Alternatives are assessed for the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative will prove successful. As appropriate, the following factors are considered: (1) magnitude of residual risk (taking into account the volume, toxicity, mobility, and propensity to bioaccumulate); (2) compliance with ARARs; (3) long term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume through treatment; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state acceptance; and (9) community acceptance.

Reduction of toxicity, mobility, or volume through treatment. The degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume are assessed, including how treatment is used to address the principal threats posed by the site.

Short-term effectiveness. The short-term impacts of alternatives are assessed considering short-term risks that might be posed to the community during implementation of an alternative; potential impacts on workers during remedial action and the effectiveness and reliability of protective measures; potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and time until protection is achieved.

Implementability. The ease or difficulty of implementing the alternatives is assessed by considering technical feasibility, administrative feasibility, and availability of services and materials.

Cost. Costs include capital costs (direct and indirect) and operation and maintenance (O&M) costs.

State acceptance. State concerns include the state's position related to the preferred alternative and other alternatives, and state comments on ARARs or the proposed use of waivers.

Community acceptance. Public review is to be performed to assess community support, reservations and/or opposition of components of the proposed remedial action.

The nine criteria listed above are categorized into three groups:

Threshold criteria. Overall protection of human health and the environment and compliance with ARARs (unless a specific ARAR is waived) are threshold requirements that each alternative must meet in order to be eligible for selection.

Primary balancing criteria. The five primary balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

Modifying criteria. State and community acceptance are modifying criteria that shall be considered in remedy selection.

The remedial alternative that best meets the requirements above is to be identified and presented to the public in this RAW. The RAW:

- Provides a summary description of the remedial alternatives;
- Provides a discussion of the rationale that supports the preferred alternative;
- Provides a summary of any formal comments received from the support agency; and
- Provides a summary explanation of any proposed waiver from an ARAR.

5.2 REMEDIAL ACTION ALTERNATIVES

Alternatives include no action, onsite placement, and off-site disposal. The three alternatives were reviewed with respect to effectiveness, implementability and cost. The evaluation is summarized below.

Alternative	Effectiveness	Implementability	Cost
No Management	Does not provide adequate protection of human health.	Administratively infeasible.	No direct costs, unknown future costs.
On-Site Placement	Burial and cover effectively eliminates potential exposure pathways. Short-term impacts reduced by provisions set forth in DMP and contractor's health and safety plan.	Readily implemented. Labor, material and equipment readily available. Requires cover with clean soil and land use controls to reduce the chance of future contact.	Moderate direct costs associated with excavation, dust control, placement, compaction and quality assurance. Annual monitoring, reporting and regulatory costs.
Off-Site Disposal	Landfill disposal effectively reduces the chance of future contact. Short-term impacts reduced by provisions set forth in DMP and contractor's health and safety plan.	Readily implemented. Labor, material and equipment readily available.	Moderate direct costs associated with excavation, dust control, transport, landfill disposal and quality assurance. No ongoing costs anticipated.

On-site placement is the preferred soil management alternative because this option is significantly more cost effective and is considered to be protective of human health and the environment.

5.2.1 No Action

The No Action alternative includes leaving affected soil in its existing condition without engineering or institutional controls. The evaluation of this alternative is summarized below.

Effectiveness

- Does not provide adequate protection of human health and the environment
- Does not effectively reduce risks
- Does not afford short-term or long-term protection
- Does not comply with ARARs

Implementability

- Immediately implemented

- Labor, material, and equipment not needed
- Administratively infeasible based on ARARs

Cost

- No direct costs
- Unknown future costs

The No Action alternative provides significantly less effectiveness than the other remedial alternatives, and does not provide adequate protection of human health and water quality. Therefore, the No Action alternative was eliminated from further consideration.

5.2.2 Excavation and On-Site Placement

The Excavation and On-Site Placement alternative includes the excavation of affected soil that exceeds the remedial goals for metals of concern; verification soil sampling and analysis to confirm that the remedial goals have been achieved; and consolidation of the affected soil on-site beneath a clean soil cap in open space. A land use covenant (LUC) and operation and maintenance agreement (OMA) are required pursuant to DTSC policy. Worker health and safety would be addressed by Site Safety Plans (SSPs) prepared by the parties involved. Provided that soil verification sample results meet the proposed remedial goals, the Crosby and Williams locations would be suitable for unrestricted land use.

Effectiveness

- Consolidation and capping of the affected soil effectively reduces human health risk by eliminating potential exposure pathways (incidental ingestion, inhalation of airborne particulates, and dermal contact with the impacted soil).
- On-site placement of affected soil is expected to be compliant with ARARs.
- Short-term impacts associated with remediation would be reduced by provisions set forth in the appended Dust Mitigation Plan (DMP) and SSPs prepared by the parties involved.
- The Excavation and On-Site Placement alternative requires a LUC and OMA for the proposed placement location, which afford long-term protection of human health by restricting future disturbance.

Implementability

- Readily implemented
- Labor, material and equipment readily available

Cost

- Moderate capital costs (estimated $57,692) associated with excavation; on-site transportation; placement, moisture-conditioning and compaction; and quality assurance observation and testing. A cost estimate is presented in Table 10.
- Moderate indirect costs (estimated $3,000 per year) associated with engineering design, development of an LUC and OMA, and periodic reporting.

5.2.3 Excavation and Off-Site Disposal

The Excavation and Off-Site Disposal alternative includes excavation of soil having lead concentrations exceeding the unrestricted land use cleanup goals; verification soil sampling and analysis to confirm that the remedial goals are achieved; characterization of the excavated soil for disposal in accordance with landfill acceptance criteria; and transportation of the impacted soil for disposal at a licensed facility in accordance with applicable regulations. Procedures required for dust and erosion control would be addressed in a DMP. Worker health and safety would be addressed in SSPs prepared by the parties involved. The evaluation of this alternative is summarized below.

Effectiveness

- Effectively protects human health by eliminating the potential exposure pathways.
- Short-term impacts associated with remediation would be reduced by provisions set forth in a DMP and SSPs prepared by the parties involved.
- Affords long-term protection of human health and the environment.
- Complies with ARARs.

Implementability

- Readily implemented
- Technically feasible
- Administratively feasible
- Likely acceptable to regulatory agencies and community. Based on an estimated hauling capacity of 14 cubic yards per truck, truck traffic is estimated to be approximately 180 truckloads for off-haul. The trucks used for off-haul would exit the Site via Providence Mine Road to Ridge Road (public roadways with single lanes in each direction). Trucks would enter State Highway 49 southbound approximately one-half mile from the Site and proceed to Ostrom Road Landfill in Lincoln, California.

- Can be performed in a relatively short time frame immediately prior to site development.

Cost

- The direct cost of Excavation and Off-Site Disposal is moderate (estimated $203,315) as summarized in Table 11. The cost estimate includes a 10% contingency, which is primarily related to uncertainties regarding the volume estimate.
- Indirect costs associated with Excavation and Off-Site Disposal include verification soil sampling and analysis, landfill characterization sampling and analysis, and reporting.
- No on-going costs associated with off-site disposal are anticipated.

5.3 PROPOSED REMEDIAL ACTION

The On-Site Placement alternative is preferred. Costs associated with the proposed remedial action are estimated in Table 10. The estimates were based on the excavation and on-site placement of approximately 1,710 cubic yards of affected soil.

The proposed remedial procedures are set forth in the following section. The proposed remedial actions are summarized below.

- Excavate, transport on-site, and consolidate mine waste that exceeds the remediation goal for unrestricted land use from the Crosby and Williams locations to the New Shaft location;
- Obtain and analyze soil samples from areas of soil excavation to verify that remedial goals have been achieved;
- Install drainage and erosion controls at the New Shaft location; and
- Establish land use controls for the New Shaft location, where mine waste (naturally mineralized soil and rock) will remain in place under a LUC.

6 HEALTH AND SAFETY PLAN

A health and safety plan (HSP) has been prepared for H&K employees, which provides information regarding potential chemical and physical hazards that may exist at the site and describes safety measures to be followed by field personnel during remedial activities. The HSP conforms to requirements of Hazardous Waste Operations and Emergency Response, Title 8 CCR, Section 5192 and Title 8 CCR, Section 5155. Appendix G presents the HSP.

Remediation contractors and subcontractors selected to perform work associated with the remediation are responsible for their own health and safety and will be required to prepare a HSP for their activities. H&K will not be responsible for the safety of contractors and site visitors. All personnel working on the cleanup shall have completed 40 hours of comprehensive health and safety training, which meets the requirements of 29 CFR 1910.120.

During the remedial activities, soil moisture content is to be maintained to reduce the potential for dust generation and the need for respiratory protection, and dust monitoring is to be performed. General procedures are set forth in the HSP and DMP, and are described below. The remediation contractor will be responsible for consulting with a Certified Industrial Hygienist to determine the appropriate levels of protection and monitoring for the remediation workers.

Based on the required application of water for dust suppression during soil excavation, airborne levels of metals are expected to be low. Real-time dust monitoring may be required if visible dust is present, to confirm that airborne metals are not present at levels exceeding the action level. When required, dust monitoring is typically performed during the first two days of soil-disturbing activities, and whenever a significant change in operations takes place that may result in additional dust generation, to confirm that the engineering controls are effective in preventing dust emissions. Airborne dust levels are to be monitored using active, real-time, data-logging aerosol monitors (e.g., a MIE pDR1200 with PM-10 inlet attached to a sampling pump).

The action level for airborne dust is 5 mg/m^3, which is equal to half of the Cal-OSHA Permissible Exposure Limit (PEL; 10 mg/m^3) for airborne dust. The airborne dust action level (5 mg/m^3) is conservatively lower than an action level for airborne dust based on metals concentrations in air. For example, dividing the Cal-OSHA action level for lead in air (30 µg/m^3) by the mean detected soil lead value (approximately 100 mg/kg) would yield a higher (less conservative) action level of approximately 300 mg/m^3 for dust in air. The Permissible Exposure Limit (PEL) for lead in air is 50 µg/m^3. The California air quality standard (30 day average) for lead in air is 1.5 µg/m^3.

If dust monitoring is performed, the dust monitoring instruments will be calibrated daily, set to log dust levels over 5 minute periods and visually read every 15 minutes. At a minimum, units will be placed at the following locations:

1. Upwind to monitor background airborne dust conditions;
2. On the backhoe operator to provide worst case dust concentrations; and
3. On the downwind property line.

If airborne dust monitoring results exceed the action level for dust in air (5 mg/m^3), additional water is to be applied to the soil, and additional engineering controls for dust suppression are to be performed as required to maintain dust concentrations below the action level. In addition to the monitoring requirements described above, the Northern Sierra Air Quality Management District requires that no visible dust cross the property line.

The lead agency or local enforcement agency may require additional dust monitoring, and may also require air sampling and analysis, at any time during the Project. If conditions arise such that additional monitoring is required, the monitoring shall be conducted in accordance with these guidelines. Air sampling and analysis, if required, is to be performed in accordance with NIOSH Method 7082, with analysis by flame atomic absorption spectroscopy (FAAS). All results of air monitoring shall be reported to the DTSC within 48 hours.

7 REMEDIAL PROCEDURES AND IMPLEMENTATION

Remedial activities will include:

- Excavation of approximately 1,710 cubic yards of mine waste (soil and rock) from the Williams and Crosby locations.
- Placement of the excavated mine waste at the New Shaft location as engineered fill.
- Burial of mine waste with the highest lead concentrations (sample location T-22) at a depth greater than ten feet bgs under engineered fill.
- Dust control during excavation and other activities that cause soil disturbance.
- Post-excavation verification sampling and analysis at the excavation locations to confirm that the mineralized soil was removed.
- Transport of the mine waste by truck to the New Shaft location (approximately 1,000 feet to the north) and placement as engineered fill.
- Placement of a soil cap (one-foot thick) over the mine waste. Cap soil is to be borrowed from on-site.
- Installation of drainage and erosion controls.

Upon completion of the remedial action, a report is to be prepared documenting compliance with this RAW, presenting the results of verification sampling and analysis, and documenting the fate of the excavated material.

DTSC must be allowed to review any proposed ground disturbing activities if the activities are to be performed prior to the implementation of the remedial action. No mine waste is to be disturbed without a DTSC-approved plan.

7.1 EXCAVATION, TRANSPORT AND PLACEMENT

Mine waste excavation includes mechanical excavation of mineralized soil and rock using a rubber-tired or track-mounted excavator. During excavation, loading, transport, placement and compaction, soil shall be moistened as necessary to avoid dust generation using water trucks or hoses.

Before removing the mine waste, vegetation shall be cut off at the ground surface, segregated, and removed from the work area. Removal of vegetation is to be performed using hand-held mechanical equipment to minimize disturbance of soil before removal.

Excavated soil and rock shall be transported by truck to the proposed mine waste placement area at the New Shaft location (Figure 2). A grading plan prepared by KPFF Consulting Engineers (May 2015) is presented as Figure 4.

Truck speed is to be limited to 15 miles per hour to reduce the chance of dust generation. The truck loading area shall be adjacent to the excavation area, so that no soil is tracked from the excavation area by trucks or other equipment.

Subgrade preparation for the placement location is to be performed prior to soil transport. Mine waste with the highest lead concentrations (detected at the New Shaft location, sample location T-22) is to be moved approximately 20 feet to the northwest within the placement area, so that it will be buried under at least ten feet of engineered fill.

Soil placement and compaction is to be performed by conventional means, in accordance with the Dust Mitigation Plan (Appendix F), the grading plan (Figure 4), the provisions of this RAW and the project geotechnical specifications.

The mineralized soil is to be covered with at least one foot of clean soil, borrowed from an on-site location that was characterized previously as part of the Site investigation. Drainage and erosion controls are to be installed pursuant to Figure 4 and the specifications of this section.

Placement and compaction of the affected soil are to be performed in general accordance with the specifications presented below.

1. Fill Placement
    a. Maintain moisture content in soil to minimize the generation of visible dust during preparation, placement and compaction.
    b. Vegetation shall be cut off at the ground surface prior to fill placement. Avoid contact with or disturbance of mine waste (mineralized soil and rock).
    c. Oversize rock (rock that is greater than 12 inches in greatest dimension) shall be incorporated into deep fill by windrowing, so that compaction is performed around the rock, as approved by the H&K field representative.
    d. Soil shall be uniformly moisture conditioned to the ASTM D1557 optimum moisture content or within approximately 3 percentage points above optimum moisture content.
    e. Fill shall be constructed by placing uniformly moisture conditioned soil in maximum 8-inch-thick loose lifts (layers) prior to compacting.

f. Fill shall be compacted to a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.

g. The moisture content, density and relative percent compaction of fill must be verified by the H&K field representative during construction. The earthwork contractor shall assist the construction quality assurance (CQA) monitor by excavating test pads with the on-site earth moving equipment.

2. Fill slope construction

   a. Fill depth will generally be less than 15 feet.

   b. Fill slopes will be 2:1, H:V, or shallower.

   c. A keyway is to be constructed at the base of the fill at least four feet deep and an equipment-width wide, as directed by H&K in the field. The base of the keyway is to be founded in competent native material, as determined by H&K in the field.

   d. Fill is to be benched into the existing slope. Benches are to extend into competent native material, as determined by H&K in the field.

   e. An intermediate drainage bench is to be graded to direct water away from the slope face per the grading plan (Figure 4).

   f. Place fill in horizontal lifts (layers) not exceeding eight inches in thickness. Overbuild the slope face and cut back to the desired slope gradient.

   g. Assist the H&K field representative with preparation of test locations so that fill density and moisture can be verified.

   h. Grade the finished surface to drain away from the constructed slope face per the grading plan.

7.2 EROSION CONTROL BMPS

Best management practices shall be implemented to reduce the chance of potential sediment discharges. BMPs are described below.

1. Exposed fill surfaces, and areas disturbed by construction activity, shall be hydroseeded or hand seeded/strawed with an appropriate seed mixture compatible with the soil and climate conditions of the site as recommended by the local Resource Conservation District.
2. Silt fences shall be installed at the down slope perimeter of the placement area.
3. Fiber rolls (straw wattles) shall be installed at the toe of slope and on contour within the placement area at a maximum spacing of ten vertical feet.

4. The earthwork contractor shall maintain and protect exposed soil from wind and water erosion. If a storm is forecasted for the area, exposed fill areas shall be sloped to drain and compacted to facilitate runoff. Plastic sheeting shall be secured over the fill prior to storm events. All existing surface drainage facilities must be kept free of soil and debris during construction. The contractor shall provide siltation control and management during construction.

Fiber rolls (straw wattles) shall be anchored in the clean soil cap with wood stakes placed 4 feet on center or closer. Fiber rolls placed on slopes should be trenched 2 to 4 inches into the soil. Additional wattles should be stored on-site during the rainy season in the event that the installed wattles are filled with sediment.

1. Prior to fiber roll installation, the subgrade shall be prepared by removing local surface irregularities and larger rock or debris that would inhibit contact of the fiber roll with the subgrade. A contoured key trench shall be excavated 2 to 4 inches deep along the proposed installation route. Soil excavated from the key trench shall be placed on the up slope side of the fiber roll to reduce the chance of surface water undercutting the roll. When more than one fiber roll is placed in a row, the rolls shall be abutted securely to one another to provide a tight joint, not overlapped.
2. Split, torn, unraveling or slumping fiber rolls shall be repaired or replaced. Fiber rolls shall be observed for damage when rain is forecasted, following rain events, and periodically as needed during prolonged rainfall.
3. Fiber rolls typically do not require removal and can be abandoned in place, once permanent erosion control is established.

7.3 POST-EXCAVATION SOIL SAMPLING AND ANALYSIS

After excavation of the mine waste, verification soil samples will be obtained from the base and perimeter of the excavations to confirm that the underlying soil is representative of local background conditions.

Soil samples will be obtained using a pre-cleaned hand trowel or individually wrapped disposable scoops, and placed in re-sealable plastic bags or glass containers provided by the analytical laboratory. Laboratory analysis for total arsenic, lead and cobalt will be performed by EPA Method 6010B.

Alternately, verification soil samples may be analyzed in the field using a hand-held X-ray fluorescence (XRF) device. If field XRF analysis is performed, a minimum of ten percent of the field-analyzed samples will also be analyzed in the laboratory by EPA Method 6010B. XRF results will be compared to the corresponding laboratory results for data validation purposes. If there is no good correlation between the XRF results and the laboratory results, all confirmation soil samples will be analyzed in the laboratory.

The minimum sample frequency will be one soil sample per 400 square feet of footprint area. In addition, soil samples will be obtained from the perimeter of the excavation area at a maximum spacing of one sample per 50 feet.

Numerical cleanup goals for arsenic and lead in soil are set forth in the table below:

Soil Cleanup Goals for Unrestricted Land Use

Constituent	**Cleanup Goal** (mg/kg)	**Basis for Cleanup Goal**	**UCL Goal** (mg/kg)
Arsenic	17.0	BTV (see Section 2.10)	13.3
Cobalt	15.0	BTV	13.78
Copper	75.8	BTV	58.55
Lead	140	BTV	80
Nickel	12.0	RBCL (see Section 4.5.1)	10.26
Selenium	<1	BTV	na
Zinc	36.1	BTV	29.2

BTV = background threshold value
RBCL = risk-based cleanup level
UCL = 95% upper confidence limit on the arithmetic mean
mg/kg = milligrams per kilogram

The lateral and vertical extent of the excavations may be increased locally to facilitate removal of soil containing metals concentrations that exceed the target cleanup levels. Additional samples will be obtained if needed to achieve the minimum sample frequency, based on the actual footprint area of the excavation.

If the verification sample analysis indicates target cleanup levels have been attained, no further excavation will be conducted. If the results of verification sample analysis indicate target cleanup levels have not been attained, further excavation will be conducted. Excavation will continue until the results of further verification sampling and analysis indicate that the cleanup goals are achieved.

Characterization of affected soil was performed as part of the site investigation. Affected soil that is to be placed on-site will not require further characterization.

7.3.1 Quality Control Procedures for Soil Sampling and Analysis

The following procedures are specified in an effort to maintain consistent quality of field and laboratory data.

Samples will be identified with the following information:

- Project number;
- Date and time of sample collection; and
- Sample identification number.

Individual sample containers will be placed in sealed plastic bags to prevent intrusion of moisture and damage to sample labels. Samples will be transported in a plastic container at ambient temperature under chain-of-custody documentation. Chain-of-custody forms will include the following information:

- Sample identification number;
- Signature of collector;
- Date and time of collection;
- Site name and project number;
- Sample matrix;
- Sample container description;
- Analyses requested;
- Special analytical procedures requested, if applicable;
- Remarks (expected interferences, hazards, unusual events at the time of sampling), if applicable;
- Preservatives added, if any;
- Special sample preparation, if applicable;
- Destination of samples (laboratory name);
- Signature of persons involved in chain of possession (relinquished by and received by); and
- Date and time of sample receipt at laboratory.

When transferring samples, the individuals relinquishing and receiving the samples will sign, date, and record the time on the chain-of-custody form. A separate chain-of-custody form will accompany each sample shipment. The method of shipment and courier name(s) will be entered on the chain-of-custody form.

Special Trainings and Certifications

The contractor is responsible for compliance with applicable health and safety regulations and for training construction personnel who are to perform soil management tasks. Personnel performing soil sampling shall be certified under OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910). Analytical laboratories will be certified by the State of California.

Documentation and Records

The project manager will distribute this plan to the project staff. Project staff will review the pertinent sections of the plan prior to performing the relevant tasks. Chain-of-custody documentation, field maps and photographs will be maintained for a period of five years following the project completion. Sample location maps, sample collection methodology and quality control procedures, laboratory reports, chain-of-custody documentation, as-built drawings of on-site soil placement locations will be included in a summary report.

Laboratory Quality Control

The laboratory will perform laboratory quality control procedures such as method blanks and matrix spike samples to assess accuracy and bias. The laboratory reporting limits will be lower than the corresponding benchmark values as set forth in this plan.

Data Validation

Data review will be performed to assess the accuracy of data recording, processing and transmittal. Field and laboratory quality control data will be reviewed for completeness. Sample preservation and holding times will be verified. Based on a review of the quality control data with respect to the data quality objectives (precision, bias, accuracy, representativeness, comparability, completeness, and sensitivity), the laboratory data will be accepted, accepted with qualification, or rejected. If data are rejected, additional verification sampling and analysis will be performed to address any data gaps.

7.4 LAND USE COVENANT

An LUC agreement and OMA are required for the on-site placement area. LUC agreements are intended to protect public health and the environment by: 1) preventing inappropriate land use, 2) increasing the probability that the public will have information about residual contamination, 3) disclosing information for real estate transactions about residual contamination, 4) ensuring that long-term mitigation measures are carried out by protecting the engineering controls and remedy; and 5) ensuring that subsequent owners assume responsibility for preventing exposure to contamination.

7.4.1 Deed Restriction

Deed restriction pertaining to the proposed 11,600-square-foot (0.27-acre) mine waste placement area at the New Shaft location will comply with the following provisions:

1. No activities that will disturb the affected soil within the on-site placement area (e.g., excavation, grading, removal, trenching, filling, earth movement) shall be allowed on the property without a soil management plan approved by DTSC.
2. Restriction of the land use within the on-site placement area is to be established by LUC agreement between the property owner and DTSC. Successive owners, heirs and assignees are to be expressly bound by the covenant.
3. Prior to the sale, lease or sublease of the property containing the on-site placement area, the owner, lessor, or sublessor shall give the buyer, lessee, or sublessee notice that hazardous substances are located in the area.
4. The land use controls shall be incorporated by reference in each and all deeds and leases for the property.
5. The owner shall provide notice to DTSC not later than 30 days after any conveyance of any ownership interest in the property containing the on-site placement area (excluding mortgages, liens, and other non-possessory encumbrances). DTSC shall not, by reason of the covenant, have authority to approve, disapprove, or otherwise affect proposed conveyance, except as otherwise provided by law or by administrative order.
6. The LUC shall be recorded in the County of Nevada.
7. The terms of the deed restriction run with the land and will continue in perpetuity unless a variance is granted or unless terminated. The property owner agrees to pay DTSC's costs in administering the deed restriction.
8. An Operation and Maintenance Agreement (OMA) will establish requirements for monitoring, reporting and financial assurance.
9. Periodic monitoring of the fill area annual reporting to DTSC will continue to be required after the remedial action is complete, to verify that the fill area has not been disturbed and signage remains in place.

7.4.2 Financial Assurance

DTSC may require financial assurance pursuant to the Hazardous Waste Control Law, as set forth in CCR Title 22, including Sections 66264.147, 66265.143, 66265.145 and 66265.147.

7.4.3 Posting

The placement area is to be posted with permanent metal signs on metal posts on each side (north, south, east and west), at locations that would be most likely visible to trespassers or other site visitors. The metal signs should include the following general language:

“This area is subject to a deed restriction recorded in Nevada County on (insert recording date in month, day, year format) in Book (insert book number) and Page (insert page number). This Deed restriction was recorded because elevated lead levels are present in soil. Human contact with the soil buried at this location should be avoided. For more information please contact the Department of Toxic Substances Control at (insert telephone number)."

7.5 FIELD VARIANCES

Variances from the provisions of this RAW will be discussed with DTSC prior to any action being taken except for emergencies (when an immediate response is required). The DTSC will be notified if an emergency response is implemented. The field variances will be documented in the Removal Action Completion Report prepared for the project.

7.6 SITE RESTORATION

After excavation, verification that RAOs have been achieved, and consultation with DTSC, the excavation areas will be re-graded to promote drainage, and erosion controls will be installed unless grading for the development project commences immediately thereafter. Where appropriate, site restoration activities will include broadcasting seed, fertilizer and straw within the excavation footprint for erosion control measures. Fiber wattles and/or silt fencing will be placed along the perimeter of the down slope sides of the disturbed areas as needed for erosion and sediment control.

7.7 REPORTING

A remedial action completion report shall be prepared to describe the remedial action and document compliance with this RAW. The report shall present:

- A summary of soil management activities;
- A description and basis for deviations, if any, from this RAW;
- Limits of excavation and volume of soil excavated;
- Results of verification sampling and analysis;
- As-built drawings depicting the location of on-site soil placement; and
- A summary of quality control activities performed during the remedial action.

8 PUBLIC PARTICIPATION

H&K will work with DTSC to conduct the appropriate and necessary public participation activities prior to and during the proposed removal action. The public participation requirements for the RAW process include:

1. The development of a community profile (see Appendix C);
2. Publishing a notice of the availability of the RAW for public review and comment;
3. Making the RAW and other supporting documents available at DTSC's office and in the local information repository; and
4. Responding to public comments received on the RAW.

Once the public comment period is completed, DTSC will review and respond to the comments received. The RAW will be revised if necessary to address the comments received. The modified RAW will be reviewed, and if deemed adequate approved for implementation by DTSC.

8.1 CALIFORNIA ENVIRONMENTAL QUALITY ACT

California Environmental Quality Act (CEQA) review is being performed by the City of Nevada City. CEQA review is expected to result in a Mitigated Negative Declaration for the proposed development project. The removal action described in this RAW is included as part of the development project for the purposes of environmental review.

The California Environmental Quality Act (CEQA) is a statute that requires State and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. In response to the passage of the National Environmental Policy Act (NEPA) in 1969, the California Legislature passed the CEQA in 1970 as a system of checks and balances for land use development and management decisions in California. CEQA was subsequently codified into the Public Resources Code (Division 13, Section 21000 et seq.). The Resources Agency adopts and certifies certain regulations (known as CEQA Guidelines) to explain and interpret the CEQA law. These regulations were codified into the California Code of Regulations (CCR), Title 14, Chapter 3, Section 15000 et seq.

CEQA is a self-executing statute with administrative procedures to ensure comprehensive environmental impact review prior to project approval. The Resources Agency does not enforce CEQA, nor does it review governmental actions for CEQA compliance. If necessary, the public may challenge a CEQA project decision in court. Where a State agency is the lead agency or a responsible/trustee agency, or where the project has statewide, regional, or area wide significance, such CEQA documents shall be submitted to the State Clearinghouse within the Governor's Office of Planning and Research for processing State agency review.

A CEQA project is a California project that has a potential for resulting in a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment. CEQA applies to discretionary CEQA projects proposed to be carried out or approved by California public agencies, unless an exemption applies.

9 REMEDIAL ACTION REPORTING

The results of the remedial activities will be presented in a post-remediation report entitled Removal Action Completion Report (RACR). The purpose of the report is to describe remedial activities and to document compliance with this RAW. The report will present:

- a summary of remedial activities performed;
- a description and basis for deviations, if any, from this RAW;
- limits of excavation and volume of soil excavated;
- results of the verification soil sampling and laboratory analyses;
- as-built drawings of the on-site placement area;
- a summary of CQA performed during placement and compaction at the approved on-site burial location; and
- a summary of site restoration activities.

The RACR will be presented to DTSC for review. Provided that the RAOs are achieved, the post remediation report will request a No Further Action decision from DTSC.

9.1 RECORD KEEPING

All Investigation and Mitigation Documents (e.g., RAW, RACR, OMA and O&M inspection forms including surveys, photographs, design specifications and as-built drawings, and appendices) will be preserved by the landowner for a minimum of 7 years after the conclusion of each relevant activity.

Example forms for routine inspection of the on-site soil placement area are presented in Appendix K. The landowner may elect to maintain paper copies of the previous 12 months reports and the latest five-year report, if applicable, and keep the rest as electronic files (e.g., in pdf format).

DTSC's Administrative Record for the Site is available for public inspection during office hours at the following DTSC location:

Brownfields and Environmental Restoration Program
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, California 95826
916 255-3591 (phone)
RAdams@dtsc.ca.gov
Attention: Randy Adams, Project Manager

9.1.1 Field Documentation

The RA contractor will be responsible for maintaining a field logbook during the RA activities. The field logbook will serve to document observations, personnel onsite, equipment arrival and departure times, and other vital project information.

Field Log

A field logbook or consecutively numbered daily field reports shall document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. Logbooks will be bound with consecutively numbered pages, or if electronic, will be consecutively numbered and contain project identification information. Entries in the field logbook will include the following for each fieldwork date:

- Site name and address
- Recorder's name
- Team members and their responsibilities
- Time of Site arrival/entry on Site and time of Site departure
- Other personnel onsite
- A summary of any onsite meetings
- Quantity of impacted soil excavated
- Quantity of excavated soils in truckloads transported on-site
- Deviations from this RAW and HSP
- Calibration readings and equipment model for any equipment used

The following information will be recorded during the collection of each sample:

- Sample identification number
- Sample location and description
- Site sketch showing sample location and measured distances
- Sampler's name
- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sample (i.e., matrix)
- Type of preservation
- Type of sampling equipment used
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.)

- Instrument readings (e.g., photoionization detector [PID], etc.)
- Transport arrangements (courier delivery, lab pickup, etc.)
- Recipient laboratory

Chain-of-Custody Records

Chain-of-custody records are used to document sample collection and shipment to laboratory for analysis. All sample shipments for analyses will be accompanied by a chain-of-custody record. Forms will be completed and sent with the samples for each laboratory and each shipment. If multiple coolers are sent to a single laboratory on a single day, chain-of-custody forms will be completed and sent with the samples for each cooler. The chain-of-custody record will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until receipt by the laboratory, the custody of the samples will be the responsibility of the sample collector.

Photographs

Photographs will be taken of the excavation area(s), confirmation sample locations, and other areas of interest onsite to document the remedial action.

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FIGURES

TABLES

APPENDIX A

Administrative Record List

APPENDIX B

Site Investigation Data

APPENDIX C

Community Profile

APPENDIX D

Local Background Soil Arsenic Data

APPENDIX E

Risk Assessment Data

APPENDIX F

Dust Mitigation Plan

APPENDIX G

Health and Safety Plan

APPENDIX H

Verification Sampling and Analysis Plan

APPENDIX I

Biological Inventory and Wetland Map

APPENDIX J

Construction Plans

APPENDIX K

Soil Management Plan and Inspection Forms