APPLIED INTELLECT

FINAL
Engineering Evaluation/Cost Analysis
Forest Hill Mill and Tailings Washout

Grand Mesa, Uncompahgre and Gunnison National Forests

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ACRONYMS

ABA	Acid-Base Accounting
ABP	Acid-Base Potential
AGP	Acid Generation Potential
AI	Applied Intellect, LLC
AM	Action Memorandum
AML	Abandoned Mine Land
ANP	Acid Neutralization Potential
AOC	Area of Concern
ARAR	Applicable, Relevant, and Appropriate Requirement
ATV	All-Terrain Vehicle
B&M	Birds and Mammals
BLM	Bureau of Land Management
CAS	Chemical Abstract Services
CCR	Colorado Code of Regulation
CDPHE	Colorado Department of Public Health and Environment
CDWR	Colorado Division of Water Resources
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CGS	Colorado Geological Survey
COC	Chain of Custody
COPC	Constituent of Potential Concern
CR	County Road
CSM	Conceptual Site Model
CSU	Colorado State University
CWA	Clean Water Act
CWCB	Colorado Water Conservation Board
Eco-SSLs	Ecological Soil Screening Level
EE/CA	Engineering Evaluation/Cost Analysis
ESV	Ecological Screening Values
ft	Feet
FML	Former Mill Lower
FMU	Former Mill Upper
GCL	Geosynthetic clay liner
GMUG	Grand Mesa, Uncompahgre, and Gunnison
HI	Hazard Index
HDPE	High-density polyetheylene
HRL	HRL Compliance Solutions
HQ	Hazard Quotient
ICP	Inductively Coupled Plasma
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
IPaC	Information for Planning and Consultation
LANL	Los Alamos National Lab
LCS/LCD	Laboratory Control Sample/ Laboratory Control Sample Duplicate

LIMS	Laboratory Information System
LTCR	Life-Time Cancer Risk
LWA	Lower Washout Area
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
µS/cm	MicroSiemens per centimeter
mg/kg	Milligram per Kilogram
mg/L	Milligrams per Liter
MOC	Media of Concern
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MTA	Main Tailings Area
NCP	National Contingency Plan
NF	National Forest
NOAEL	No Adverse Effect Level
NPS	United States National Parks Service
NPR	Neutralization Potential Ratio
NRWQC	National Recommended Water Quality Criteria
NFSR	National Forest Service Road
NRCS	United States Department of Agriculture, Natural Resources Conservation Service
ORNL	Oak Ridge National Laboratory
ORP	Oxygen Reduction Potential
P&I	Plants and Invertebrates
QA/QC	Quality Assurance/Quality Control
RACR	Removal Action Completion Report
RBSL	Risk-Based Screening Level
RCRA	Resource Conservation Recovery Act
RDL	Reported Detection Limit
RME	Reasonable Mean Exposure
RPD	Relative Percent Difference
RSL	Regional Screening Level
SDG	Sample Delivery Group
SAP	Sampling and Analysis Plan
SDWA	Safe Drinking Water Act
SL	Screening Level
SOW	Scope of Work
T&E	Threatened and Endangered
TBC	To Be Considered
TVS	Table Value Standards
USEPA	United States Environmental Protection Agency
USFS	United States Department of Agriculture, Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UWA	Upper Washout Area
WQCC	Water Quality Control Commission

EXECUTIVE SUMMARY

The United States Department of Agriculture, Forest Service (USFS) Grand Mesa, Uncompahgre and Gunnison (GMUG) National Forests has contracted Applied Intellect, LLC (AI) to perform an Engineering Evaluation/Cost Analysis (EE/CA) for the Forest Hill Mill and Tailings Outwash Site (the Site) in Gunnison County, Colorado. This EE/CA was performed in accordance with Schedule of Items presented in the USFS Statement of Work (SOW) Task Order No. 1282MK18F0023, and Modification No. P00001, dated August 27, 2018. This report presents the results of the EE/CA for the Site.

The USFS is evaluating a non-time critical removal action (NTCRA) at the Site to address mill tailings that contain high levels of metals that may be hazardous to human health and the environment, in accordance with the National Contingency Plan (NCP) 40 Code of Federal Regulations Part 300.415 (40 CFR 300.415) Removal action. 40 CFR 300.415 requires consideration of eight factors, including the three factors provided below that are potentially relevant to the Site:

1. Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
2. High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate; and
3. Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

Based on these factors, the scope, goals and objectives of this NTCRA are to reduce the potential for exposure to humans, and ecological receptors to acceptable levels, and reduce the potential for contaminants to migrate or be released.

The Site consists of the remnants of a mill and surrounding tailings and is located near the junction of National Forest Service Road (NFSR) 742 (Taylor Road) and NFSR 748, approximately six miles north of Taylor Park Reservoir in Gunnison County, Colorado. The mill is located on an elevated slope directly south of Trail Creek. During historic operations, it appears that tailings from the Upper and Lower Former Mill were discharged downslope of the mill site to the Main Tailings Area northeast of Trail Creek, between Trail Creek and County Road (CR) 748. Most of the material located closer to the mill and some washout material appears to have been transported via surface water runoff to the southeast. Additional tailings washout material has crossed CR 748 through a valley draw and was deposited into an Upper Washout Area, and into the depositional plain south of Taylor River, called the Lower Washout Area.

The USFS conducted a Site Inspection (SI) in 2010 to evaluate the washout areas documented in 2012 (HRL Compliance Solutions, Inc [HRL], 2012), which identified elevated metals in the washout areas but did not address the mill site. During the initial site walk for the EE/CA, the mill site was identified as a potential source of metal loading, and other data gaps were identified that required additional sampling and analysis including Acid Base Accounting (ABA), and

evaluation of soil nutrients. Background soil concentrations, metal concentrations in the MTA and the Synthetic Precipitation Leaching Procedure (SPLP) results determined by HRL (2012) are utilized in the current EE/CA.

Between October 8, 2018 and October 11,2018, AI conducted environmental sampling (surface soil, surface water and sediments), volume analysis, and onsite repository assessment at the Site. surface soil samples, 0-6 inches below ground level, were collected and composited to represent the exposure concentration for human and ecological receptors in eight areas of concern (AOCs). Three surface water samples and three sediment samples were collected from Trail Creek (upgradient for background, adjacent to the mill, and downgradient of the Main Tailings Area). Samples were analyzed for inorganic metals associated with mine tailings to evaluate the magnitude of the risk to human health and the environment. ABA was also conducted for surface soils to evaluate fate and transport mechanisms. Soil nutrients were assessed to evaluate requirements for revegetation.

A streamlined risk evaluation was conducted, which compared environmental sample results to observed background concentrations, and to human health and ecological risk-based screening levels (RBSLs). In surface soil, lead exceeded human health RBSLs at the Former Mill- Lower, Main Tailings, and Upper Washout AOCs; and several metals exceeded ecological RBSLs in all AOCs. In surface water, arsenic exceeded human health RBSLs; and copper exceeded ecological RBSLs. In sediments, cadmium exceeded ecological RBSLs.

Based on the results of the streamlined risk assessment, three alternatives were evaluated to meet the scope, goals and objectives of the removal action, which include action objectives, including No Action as a baseline comparison:

- Alternative 1: On-Site Repository with Impermeable Cap, and In-situ Stabilization with Amendments, Revegetation;
- Alternative 2: Off-site Repository, In Situ Stabilization, Revegetation; and
- Alternative 3: No Action.

In accordance with non-time-critical removal action guidance (USEPA, 1993), these three alternatives were evaluated against the following criteria: effectiveness, implementability, and cost. Alternative 1 was chosen as the preferred alternative at a rough order of magnitude cost of $766,000. This alternative includes:

- Removal of the former mill soil, waste rock and debris for consolidation in an on-Site repository would protect ecological receptors, and reduces the potential for human exposure to the former mill soils; the physical hazard posed by the former mill slope and debris would be reduced by stabilizing the steep slope;
- Removal of the tailings and/or contaminated soil from the AOCs downgradient of the former mill for consolidation in an on-Site repository would protect ecological receptors and reduce the potential for exposure to the AOCs downgradient of the former mill area;

- Receptor exposure to the soil metals would be reduced by consolidation in the on-Site repository and covering wastes with the protective and vegetative layers;
- Covering the waste materials with protective and vegetative layers would reduce the potential for contaminants to migrate to the subsurface for long-term protectiveness;
- The waste could be consolidated and covered in a single field season, providing immediate short-term effectiveness; and
- Throughout the AOCs where tailings are thin, soil amendments may be applied, rather than removal of tailings to the onsite repository.

1. INTRODUCTION

The United States Department of Agriculture, Forest Service (USFS) Grand Mesa, Uncompahgre and Gunnison (GMUG) National Forest (NF) has contracted Applied Intellect, LLC (AI) to perform an Engineering Evaluation/Cost Analysis (EE/CA) for the Forest Hill Mill Site in Gunnison County, Colorado. This EE/CA was performed in accordance with Schedule of Items presented in the USFS Statement of Work (SOW) Task Order No. 1282MK18F0023, and Modification No. P00001, dated August 27, 2018.

Following Notice to Proceed on June 1, 2018, AI prepared the project Work Plan, and Health and Safety Plan (AI, 2018). The USFS and AI conducted the site visit and reconnaissance on July 12, 2018. As a result of the site visit and subsequent discussion meeting, the USFS determined that collection of additional data would be required to develop the EE/CA. AI submitted a Work Plan Addendum (AI, 2018a) to USFS on September 20, 2018, including a Sampling and Analysis Plan (SAP) prior to performing the site characterization.

This EE/CA report presents the results of the site characterization, streamlined risk assessment, Applicable or Relevant and Appropriate Requirements (ARARs), and the identification and comparison of removal action alternatives to support the EE/CA. The EE/CA was developed in accordance with United States Environmental Protection Agency (USEPA) guidance (USEPA, 1993).

1.1 Purpose and Scope

The purpose of this EE/CA is to evaluate a limited number of removal action alternatives for this Site which would substantially reduce the threat to public health or welfare, or the environment associated with exposure to tailings and historical mine waste hazards related to the former mill and remnant features surrounding and downstream of the former mill. The following removal action objectives have been identified:

- Control contaminant source areas (soil and tailings) from migration to nearby surface water or other media/areas; and
- Reduce potential contaminant exposure to recreational visitors and the surrounding environment.

1.2 Report Organization

This document is organized as follows:

Section 1 – Introduction, including Purpose and Scope, and Report Organization
Section 2 – Site Description and Summary of Previous Investigations
Section 3 – Source, Nature and Extent of Contamination
Section 4 – ARARs
Section 5 – Streamlined Risk Evaluation

2. SITE DESCRIPTION AND SUMMARY OF PREVIOUS INVESTIGATIONS

Figure 2-1 shows the approximate location of the Site within the State of Colorado and the Gunnison NF. It is located approximately 100 miles southwest of Denver within the Gunnison NF. The legal description for the Site references the Pieplant, Colorado 7.5-minute United States Geological Survey (USGS) quadrangle within Sections 12 and 13, Township 13 South, Range 83 West, 6th Principal Meridian in Gunnison County, Colorado.

2.1 Site Location

Figure 2-2 shows the Site vicinity and the approximate location of the Site near the junction of National Forest Service Road (NFSR) 742 (Taylor Road) and NFSR 748, approximately six miles north of Taylor Park Reservoir in Gunnison County, Colorado. The Site is approximately two miles west of the Forest Hill Mine. The mine site is not included in the EE/CA. Figure 2-3 provides the layout of the former mill site, existing tailings, and washout areas. The former mill area is located on the south side of Trail Creek approximately 500 feet southwest of the tailings area. Trail Creek is south of the tailings area and flows east approximately 0.5 miles to the Taylor River. Additional features include the upper and lower washout areas (UWA and LWA, respectively) located north and east of the tailings area across NFSR 748. All features presented on Figure 2-3 lay within the Gunnison NF administrative boundaries.

2.2 History

There is limited history describing the Forest Hill Mine or the Forest Hill Mill Site. According to the Colorado Geological Survey (CGS, 1999), the Taylor Park Mining District includes a large area of diverse geology near the upper Taylor River. The district included mines on the northeast slope of North Italian Mountain, the Star Mine in upper Italian Creek, the Forest Hill and Paymaster mines in the upper drainage of Trail Creek southwest of Taylor Park, and the Pieplant Mine to the northeast of Taylor Park. Specific information on the mines and deposits of this mining district is lacking (CGS, 1999). Deposits at the Pieplant Mine are most likely fissure veins that were worked for gold and silver. Deposits near North Italian Mountain were reportedly of the lead, zinc, and silver replacement type hosted by carbonate rocks.

Limited historical information regarding mill production is available. The Forest Hill Mine is in a small part of the historical, but poorly defined, Taylor Park District (Vanderwilt, 1947). From 1932 to 1945 as many as 3 lode mines were operating in the Taylor Park District. It is assumed that the Forest Hill and Paymaster were two of these and were the principle mines contributing to the 101 ounces of gold, 21,890 ounces of silver, 5,500 lbs. of copper, 607,600 lbs. of lead, and 139,400 lbs. of zinc produced from the district. It is assumed that the Forest Hill Mill Site was likely used to process these minerals from the mines in the Taylor Park Mining District.

Documentation of the operational procedures of the former mill site were not discovered during the research associated with this CERCLA evaluation. Operations were interpreted based on limited remnant features (e.g., burnt wooden timbers and debris) and internet research of

historical mill site photographs and descriptions. The natural topography (steep slope) of the former mill indicates that it may have operated as a gravity stamp mill. Historical stamp mills primarily consisted of a crusher or stamp mill at the top tier, that was operated with flowing water to crush large rock ore into a fine-grained sandy pulp. Historical photographs of gravity stamp mills feature large tanks in lower tiers that may have been used as collection vessels. As reported in a previous study for the Site in the *Assessment Summary Report, Forest Hill Mill Site, Gunnison County, CO* prepared by HRL Compliance Solutions, Inc (HRL, 2012), mill tailings were subsequently transported downgradient through a culvert beneath NFSR 748 by surface water runoff to the Upper Washout Area.

2.3 Geology, Hydrogeology, and Topographic Features

Precambrian intrusive and metamorphic rocks are the most extensive in the Taylor Park area. Sedimentary rocks of Paleozoic and Mesozoic eras occur as remnants of synclines or down-faulted blocks, including sandstone, conglomerate, shale, and limestone. Surficial quaternary glacial drift deposits consist of unsorted boulders and sands, gravels according to the United States Department of Agriculture, Natural Resources Conservation Service (NRCS, 1963).

A geologic map of the Taylor Park area from the CGS (1999) indicates that the oldest rocks in the vicinity of the Site are granitic and of Proterozoic age, consisting of granodiorite, gneiss and quartz monzonites, and younger Sawatch quartzities of Mississippian age. Veins and/or replacements occur in the Proterozoic granite.

Figure 2-4 illustrates the groundwater wells located in the Site vicinity. A survey of wells near the Site was conducted on the Colorado Division of Water Resources (CDWR, 2018) website. Table 2-1 provides the available well construction information from the website, summarized below:

- The nearest permitted well (permit number 1276) is approximately 1.2-miles northeast of the Site and approximately 0.5 miles across the Taylor River. The well is classified “residential-domestic”. There is no further data in the CDWR database regarding depth of the well or construction details.
- There are four additional wells identified approximately 1.5-miles east of the Site along Red Mountain Creek and approximately 0.8 miles across the Taylor River. All four wells are designated “household use only”, range from 83-to 110-feet deep, with static water levels ranging from 57 to 87-feet deep.
- The depth to groundwater at the Site is unknown, and it is not determined whether there is a connection from the Site to the permitted groundwater wells identified above. However, all wells are located on the eastern side of the Taylor River, which separates them from the Site and is a likely hydraulic barrier for groundwater traveling from the Site to the wells.

The topography of the Site and Taylor River region is typical of glaciated mountainous regions. Altitude ranges from 8,000-feet above mean sea level (amsl) at the town of Almont (approximately 30 miles southwest of the Site) to 14,000-feet amsl at the crest of the Taylor River

watershed. The Sawatch Range is part of the continental divide and is also the northern and eastern boundary of the Taylor River area. The area is characterized by steep, glaciated mountains with barren, knife-edged ridges and peaks. Valleys are steep and u-shaped. In unglaciated parts of the area, the stream divides are broad and rolling, and valley walls are v-shaped. The streams in both the glaciated and unglaciated areas have high gradients and narrow flood plains (NRCS, 1963).

The mountains surround two relatively large mountain park areas, Taylor Park and Union Park. Taylor Park is a long, narrow, open grassland in a basin enclosed on the north and east by glacial moraines and on the west by steep mountain slopes. The large, grassy park is an open mountain valley surrounded by forest. Relatively flat fluvio-glacial terrace deposits are adjacent to Taylor River and its tributaries (NRCS, 1963).

The central part of the Taylor Park Area is drained by the Taylor River and its tributaries. The larger tributaries include Willow Creek, Texas Creek, Illinois Creek, and Italian Creek (Trail Creek, located at the Site, is a smaller tributary). Snow begins to melt in the area in May, and peak runoff occurs the first or second week in June. Stream flow fluctuates widely except in streams that originate in materials that are porous or have deep regoliths, such as glacial deposits and the Maroon conglomerate. Many springs in the area help maintain uniform stream flow in late summer. Lakes and ponds are in glacial moraines and in streams dammed by beavers (NRCS, 1963).

The Taylor Park Reservoir is predominately used to store water for supplemental irrigation water supply while also providing coordinated releases for environmental and recreational uses on the Taylor River. The reservoir is the third largest storage reservoir in the Gunnison Basin, with a normal storage of 106,200 acre-feet according to the Colorado Water Conservation Board (CWCB, 2006).

2.4 Current Site Features for EE/CA

The general site features pertinent to the site characterization and EE/CA are described below and shown on Figures 2-5 and 2-6. These features are generally consistent with those identified in a previous study performed for the USFS (HRL, 2012). The general features and areas of concern (AOCs) are identified as follows, and described in further detail in Section 3:

- Former mill, consisting of burned remnant mill debris on a steep slope directly south of Trail Creek, accessible via a small hiking trail. The steep slope and remnant debris of the former mill area pose physical hazards;
- Main Tailings Area (MTA AOC), a broad, largely non-vegetated area originating directly north of Trail Creek across from the former mill and extending northeast and east toward NFSR 748;
- Upper Washout Area (UWA AOC), located immediately north of NFSR 748 across from the MTA in a ravine that trends to the northeast approximately 1,200 feet long and tapers in width;

- Lower Washout Area (LWA AOC), located directly east of the UWA on the alluvial floodplain of Taylor Park Valley. NFSR 748 traverses through portions of the lower washout; and
- Trail Creek located directly adjacent to the former mill and south of the MTA and LWA.

2.5 Previous Investigation

2.5.1 Background

As referenced above, the previous study (HRL, 2012) indicated that historically the tailings deposited from the former mill were transported to the main tailing deposits at MTA1 and MTA2 and subsequently migrated downgradient through a culvert beneath NFSR 748 via surface water runoff to the UWA (UWA1 and UWA2), and then further down the drainage to the LWA (LWA1 and LWA2). The eastern edge of the LWA2 footprint appears to be within approximately 800 to 1,000 feet of the Taylor River. Currently there is no direct surface water flow from the MTA1 and MTA2 to the UWA. Samples collected in this previous study include vegetation, tailings soil, tailings washout sediments and surface water.

In addition, the assessment summary report identified an apparent wetlands area adjacent to the west edge of the tailings area. The report described the wetlands as resulting from groundwater discharging along seeps at the base of a hillside. In 2010, during the field study conducted for the assessment summary report, water flowing through the wetland was observed to infiltrate back into the ground before entering the tailings area and indicated that the wetland may have extended across a portion of the main tailings area before deposition of tailings occurred. Excavation of a dark, organic-rich native soil beneath the tailings was observed in test holes excavated within the MTA during the previous investigation.

Finally, the former mill site and tailings area are located within 500 ft of Trail Creek, a tributary of the Taylor River, whose water was used to operate the mill. It was noted that the 2012 investigation did not collect samples from the separate former mill location, which appears as a potential source of contamination. During AI's site visit and reconnaissance performed in July 2018 for the current EE/CA investigation, it was observed that the former mill area features mine wastes that are in direct contact with surface water and the stream ecosystem of Trail Creek. Material that appeared to be tailings were observed along the Trail Creek embankment and in the stream eddies. The former mill tailings are likely subject to transport from ground surface into Trail Creek at this location by storm water run-off during periods of high precipitation.

2.5.2 Previous Investigation Findings

The results of the previous investigation performed in September 2010 are detailed in the Assessment Summary Report (HRL, 2012). The previous assessment included results from sampling tailings material, and soil that is presented in Table 2-2 and results from sampling surface water presented in Table 2-3. AI performed a site visit and reconnaissance with USFS in July 2018 and identified the following data gaps:

- The former mill site was not included in the previous assessment. The former mill site currently includes approximately 3,800 square feet of tailings and mill debris on a steep slope directly above Trail Creek, with the toe of the sloped tailings within 40 feet (ft) of the water body. The former mill is accessible via a small hiking trail near the fork of NSFR 748C from NFSR 748. The former mill area poses physical hazards, and tailings extended approximately 100 feet from the sloped pile into Trail Creek. In addition, aerial images indicated a large disturbed area on a flat bench above the top of the slope. This area is accessible via an all-terrain vehicle (ATV) access road.
- The previous assessment included collection of two surface water samples from Trail Creek. One sample was a background sample collected from upstream of the former mill site, and the second sample was collected approximately 2,000 feet downstream from the former mill site. In general, the downgradient water sample showed lower metal concentrations then the background sample, indicating that there was insignificant surface water loading from the Site to Trail Creek over this reach, however there was uncertainty associated with this characterization of surface water. In addition, stream sediments were not collected during the previous investigation, which presented a data gap.
- One composite soil sample was collected from the MTA comprised of ten sub-samples and analyzed for metals. Results for lead [14,200 milligrams per kilogram (mg/kg), and 18,500 mg/kg (duplicate)] exceed the BLM camper screening level (SL) (800 mg/kg). These metals data are considered usable for a portion of the MTA.
- One discrete soil sample with no sub-samples was collected from the UWA and analyzed for metals. The results indicated that lead (7,350 mg/kg) exceeded the BLM Recreational SL (800 mg/kg) in this sample.
- One discrete soil sample with no sub-samples was collected from the LWA and analyzed for metals. The results indicated that lead and cadmium (571 mg/kg and 18.1 mg/kg, respectively) exceeded the BLM background and livestock screening criteria (127 and 3 mg/kg for lead and cadmium, respectively).

2.5.2.1 *Synthetic Precipitation Leaching Procedure Results*

As part of the previous investigation (HRL, 2012), SPLP analysis was conducted on the composite tailings sample (FH-TL-1) collected from MTA1, its duplicate (FH-TL-FHD) and the soil beneath MTA1 (FH-TL-2) (HRL,2012). Data is presented in Table 2-4.

To evaluate the potential impact of metals in tailings leaching to groundwater in infiltrating meteoric water, SPLP results were compared to USEPA Regional Screening Levels (RSLs) (USEPA, 2018b) for residential tap water multiplied by a dilution/attenuation factor (DAF) of 20 (SPLP RBSLs). SPLP results that exceeded SPLP RBSLs for tailings at MTA1 (FH-TL-1 and FH-TL-FHD) are summarized below:

- Arsenic exceeded the SPLP RBSL by a range of 1 to 3 times;
- Cadmium exceeded the SPLP RBSL by a range of 1 to 2 times;
- Lead exceeded the SPLP RBSL by a range of 26 to 30 times; and

- Zinc exceeded the SPLP RBSL by a range of 10 to 13 times.

Based on these results from MTA1, it is recommended that the chosen remedial alternative mitigates the potential for lead and zinc to leach to groundwater from tailings from MTA1 and FML AOCs.

3. CURRENT INVESTIGATION ACTIVITIES AND FINDINGS

To complete the data gaps described above, AI characterized the Site as separate AOCs described below. The AOCs are generally consistent with those identified in the previous study; however, modification to the previous delineations included further separating some of the AOCs into sub-areas based on visual observations and other rationale detailed in the SAP (AI, 2018a). Appendix A provides a summary of the field notes developed for this investigation.

3.1 Former Mill Area (FMU and FML)

The former mill consists of burned remnants and debris of the former mill located on a fan-shaped un-vegetated steep slope, with waste rock remnants located approximately 500 feet southwest of the MTA. In addition, mill site debris was observed on the upper areas of the slope (Former Mill Upper or FMU), including remnants of mill tailings covering approximately 6,000 ft^2. An access road for recreational vehicles is located directly south of FMU, which accesses NSFR 748. For purposes of the 2018 site characterization, the former mill was separated into the upper portion of the former mill and the lower portion of the former mill based on the observation of quantity of tailings as shown in Figure 3-1.

- FMU is located at the uppermost portion of the former mill at the top of the slope where less tailings were observed; and
- Former Mill Lower (FML) is located at the broader and larger middle and lower portions of the fan-shaped slope. The bottom bench of the FML encroaches on Trail Creek. The FML was the location of a large amount of tailings.

3.2 Main Tailings Area (MTA1 and MTA2)

In the previous investigation, the MTA was delineated immediately north of the former mill site and extending north and east of Trail Creek toward NFSR 748 as shown in Figure 3-2. For purposes of the 2018 site characterization, the MTA was separated into two AOCs based on the quantity of tailings observed:

- MTA1 is the location of the main tailings piles that were characterized in the previous investigation where visible surface tailings appeared more prominent during the site reconnaissance; and
- MTA2 is the lower eastern portion of the original MTA that appeared less impacted than MTA1, with surficial gravels and coarser grained sediments that displayed sparse to moderate vegetative cover. In addition, the MTA2 area features some large pits or depressions that are primarily comprised of gravel and do not appear to contain tailings material at the surface.

3.3 Upper Washout Area (UWA1 and UWA2)

The UWA is located across NFSR 748 from the MTA as shown on Figure 3-3. The UWA is in a shallow ravine downgradient of the MTA1 and MTA2 (approximately 1,200 ft long, ranging from approximately 100 ft wide at the western end to approximately 20 ft wide at the eastern end). The ravine drops about 100 ft in elevation from west to east. It appears that tailings were transported from the MTA areas by either a single large storm event or multiple storm events over time. During the 2018 site characterization, the UWA was split into two AOCs based on quantity of tailings observed.

3.4 Lower Washout Area (LWA 1 and LWA2)

The LWA is located directly east of the UWA on the alluvial floodplain of Taylor Park Valley (Figure 3-4). NFSR 748 traverses through portions of the LWA. It appears that contaminated waters from the MTA flowed through the UWA into the alluvial plain of the LWA during one or more large storm events and left the LWA devoid of vegetation. For purposes of the 2018 site characterization, the LWA was separated as follows:

- LWA1: The southwestern lobe (approximately 1.8-acres) that appears to be more frequently visited by campers (presence of fire pits); and
- LWA2: The northeastern lobe (approximately 2.0 acres) of the LWA.

3.5 Sampling Media and Analyses

Per the SAP (AI, 2018a), sampling media and sampling methods consisted of the following:

Surface soil/tailings: Six (6) to seven (7) surface soil and/or tailings material samples were collected from 0- to 6-inch depth and combined into a single composite sample representative of each AOC. Sampling locations are shown on Figures 3-1 through 3-4.

In accordance with the SAP, the sampling equipment (sharp-shooter shovel and hand-trowel) were decontaminated with an Alconox solution wash and de-ionized water rinse between collection of each composite sample. The individual samples for each composite were blended in a bucket with a disposable plastic liner and homogenized (removal of small rocks and organic matter) before being placed in certified pre-cleaned sampling jars and sealable bags provided by the analytical laboratory.

Chemical analyses of surficial soil and/or tailings included metals analyses (see Table 3-1 for sample identifications and constituents) and Acid Base Accounting (ABA) to evaluate whether waste materials are potentially acid generating. In addition, soil nutrient analyses were performed to evaluate current levels of organic matter and soil macronutrients (nitrogen, phosphorous, and potassium). AOCs and the number of sub-samples included:

- FMU: One composite of six samples (FHM-FMU-SS-001), including extra volume for matrix spike/matrix spike duplicate (MS/MSD) analysis;
- FML: One composite of seven samples (FHM-FML-SS-001);
- MTA1: One composite of seven samples (ABA and nutrients only as per SAP), (FHM-MTA1-SS-001);
- MTA2: One composite of six samples (FHM-MTA2-SS-001) and one duplicate composite sample of six samples (FHM-UA-SS-001);
- UWA1: One composite of six samples (FHM-UWA1-SS-001);
- UWA2: One composite of six samples (FHM-UWA1-SS-002);
- LWA1: One composite of six samples ((FHM-LWA1-SS-001); and
- LWA2: One composite of six samples (FHM-LWA1-SS-002).

Surface water and sediment samples were collected from three (3) locations in Trail Creek for analyses of metals and hardness as shown in Figure 3-5. Surface water samples were collected using a peristaltic pump and disposable silicone tubing to fill certified pre-cleaned containers provided by the laboratory. Samples that were collected for dissolved metals analysis were field-filtered using a disposable 0.45-micron filter followed by preservation with nitric acid. Field parameters (temperature, dissolved oxygen, specific conductance, pH, oxidation reduction potential [ORP], and turbidity) were measured.

- FHM-TC-SWSD-001 was the location of background surface water sample FHM-TC-SW-001 and background sediment sample FHM-TC-SED-001, upgradient of the former mill and outwash, adjacent to NSFR 748C;
- FHM-TC-SWSD-002 was the location of surface water sample FHM-TC-SW-002 and sediment sample FHM-TC-SED-002 at the former mill outwash directly downgradient of the former mill; and
- FHM-TC-SWSD-003 was the location of surface water sample FHM-TC-SW-003 and sediment sample FHM-TC-SED-003 approximately 1,700 feet east of the former mill area.

All samples were labeled upon collection in accordance with the naming convention indicated in the SAP. None of the analytical parameters required preservation of the samples on ice. The soil, sediment and water samples were hand-delivered to the local courier office of Pace Analytical Laboratories (Pace) in Mount Juliet, Tennessee on October 12, 2018. The ABA samples were shipped to ACZ Laboratories Inc. (ACZ) in Steamboat Springs, Colorado on October 12, 2018. Soil nutrient samples were shipped to the Colorado State University (CSU) Soil, Water, and Plant Testing Laboratory in Fort Collins, Colorado on October 18, 2018.

3.6 Supporting Data

As per the SAP (AI, 2018a), supplemental data collection in the field included excavation of test pits to 1) measure thickness of surface tailings at specific AOCs, and 2) evaluate soil lithology and depth at two potential repository locations. In addition, supporting data included stream flow measurements at the Trail Creek sampling locations, documentation of soil lithology at sampling

locations, collection of Global Positioning System (GPS) coordinates, photographs, and field notes/observations to support the EE/CA. The results of supporting data collected are provided in subsections below.

3.6.1 Test Pits – MTA1

Nine test pits at MTA1 were excavated on October 11, 2018 using a John Deere 35G mini-excavator as shown on Figure 3-6. The test pits were excavated to a maximum depth of approximately 4-ft to: 1) Estimate tailings thickness across the MTA1 area, and 2) Characterize the subsurface lithology in MTA1 beneath surficial tailings.

In general, surficial tailings are distributed throughout the MTA1 area, with the estimated thickness ranging from 0- to 12-inches. Tailings were observed to be distinct in color and texture, and somewhat localized (e.g., at one test pit location there were no tailings on one end of the pit and approximately 6-inches at the other end). Table 3-2 provides a summary log of tailings thickness for test pits excavated at MTA1.

In general, the lithology of MTA1 beneath the varying surficial tailings consists of 6-inches to 1-foot of sand, loamy, dark brown and moist with organic material, underlain by reddish to grayish brown alluvium/colluvium, consisting of sand and gravel with occasional cobble-sized materials. The shallow subsurface lithology observed at MTA1 appears similar to the existing "pits" or depressions that are present within MTA2 that feature primarily sands and gravels within these depressions.

Originally per the SAP (AI, 2018a), test pits were planned for MTA2. However, field observations and collection of soil samples at MTA2 on October 8, 2018, indicated that obvious surficial tailings were limited to approximately 3 locations and ranged from 1- to 2-inches thick. The thickness of tailings was determined with hand-shovels. Therefore, excavation of test pits was determined unnecessary in MTA2.

3.6.2 Test Pits – Potential Repository Areas

Test pits were excavated at two locations within terrace deposits that are located to the west and above the lower washout areas (Figure 3-7). These areas were chosen as preliminary or potential evaluation areas for repository locations, based on the following:

- Proximity to the waste materials (tailings and potentially contaminated soil) at the former mill site, main tailings areas, and upper and lower washout areas;
- Proximity and access to NSFR 748 for potential transport of waste materials;
- Terrace deposits are elevated (roughly 15 to 25 feet) above the lower washout areas and floodplain of Trail Creek and the Taylor River;
- Terrace deposits are large and could potentially have sufficient capacity to manage the Site waste; and

- Terrace deposits are relatively flat and in an open area that could potentially be reclaimed back to the original grade without significant disturbance to the surrounding natural topography.

The test pits were excavated to approximately 6-ft depth at the two locations shown on Figure 3-7, determined using hand-held GPS equipment. The general lithology encountered at both locations is summarized as follows:

- 0- to 6-inches: Topsoil, dark brown, some roots and organic materials, moist;
- 6-inches to 3.5 ft: Alluvium/colluvium, sand with gravel and cobbles, dry to light moist, including occasional boulders up to 12-inch diameter, rounded;
- 3.5- to 6-ft: Alluvium/colluvium, tan to grayish brown sands and gravels, dry to light moist, uniform (generally lacking cobbles and boulders); and
- No saturated materials or groundwater was encountered.

The lithology and results of excavating exploratory test pits at these locations indicate that either of these areas show potential for a repository location, based on the conditions noted above, and that these materials could be excavated with a small mini-excavator.

3.6.3 Flow Measurements in Trail Creek

AI performed flow measurements at three locations in Trail Creek in proximity to FHM-TC-SWSD-001, FHM-TC-SWSD-002, and FHM-TC-SWSD-003 as shown on Figure 3-5. The results are provided below, and measurements are given in Appendix A - Field Notes.

Location	Date	Time	Flow (CFS)
SWSD001	10/09/2018	12:45	2.4
SWSD002	10/09/2018	13:45	2.3
SWSD003	10/09/2018	14:45	3.0

CFS – Cubic feet per second
SWSD001 – Upgradient from the mill (background)
SWSD002 and duplicate SW-004 - Adjacent to the mill site.
SWSD003 - Downgradient from MTA2

3.6.4 Acid-Base Accounting

ABA analysis was conducted by ACZ Laboratory for all soil samples collected at the former mill and downgradient AOCs. The analytical results are provided in Table 3-3 and Appendix B.

ABA is used to estimate the leachability of metals in mine waste by establishing the acid generation potential (AGP) and acid neutralization potential (ANP) of the waste in units of tons of calcium carbonate per kiloton (t $CaCO_3$/Kt).

- The ratio of ANP to AGP (ANP/AGP) is the neutralization potential ratio (NPR), a characterization of the leachability of the metals in the waste rock/tailings waste and its suitability to be stored in a repository as non-hazardous waste. The BLM identifies an NPR of 3 or greater to characterize material as unhazardous without additional testing, or evaluation of other parameters (for example, sulfide sulfur content as addressed below), may be required.
- The difference of ANP minus AGP (ANP-AGP) is the acid-base potential (ABP), which is another test of leachability. The USGS indicates that an ABP of greater than 20 t $CaCO_3$/Kt is generally accepted as non-acid generating material, and an ABP of -20 t $CaCO_3$/Kt is generally accepted as acid generating material. ABP less than 20 but greater than -20 ma needs kinetic testing to evaluate further.

In addition, ABA provides an estimate of acidity of each soil sample using pH paste analysis, where pH of less than 6 is acidic, greater than 8 is basic, and between 6 and 8 is neutral.

In Table 3-3, ABA results for the Site indicate:

- pH ranges from 4.3 to 5.5 in the seven samples collected; the lowest pH of 4.3 was identified in the sample from the lower mill area;
- AGP ranges from 1.56 t CaCO3/Kt in the lower washout area to 92.20 t CaCO3/Kt in the lower mill area;
- ANP ranges from 0 t CaCO3/Kt at the lower mill, MTA1, and UWA, to 3 CaCO3/Kt at the upper mill and lower washout areas;
- NPR ranges from 0 t CaCO3/Kt at the lower mill, MTA1, and UWA, to 1.9 t CaCO3/Kt at LWA2; and
- All NPR results for the seven samples collected are below the BLM criteria of ANP/AGP ratio of >3. Based on the more conservative BLM criteria, the results indicate that all seven results would be potentially acid-generating and may be susceptible to leaching of metals.

In addition to NPR, the Sobek Method (USGS, 2003) evaluates acid generation potential based on sulfide sulfur content. Theoretically, an upper boundary of 9 percent (%) sulfide sulfur or greater would indicate that the specific material is acid-generating and that all other waste material would need to contain 100% calcium carbonate to neutralize the materials to achieve the NPR of 3 or greater. The Site results for sulfide sulfur (total sulfur minus sulfate sulfur) indicate that six of the seven samples collected were less than 1% (ranging from 0.03% to 0.24%). The highest sulfide sulfur was identified at the sample from the lower mill area at 2.2%, approximately 4 times less than the upper boundary of 9%. Table 3-4 presents a tabular summary of the Sobek sulfide-sulfate comparison.

In addition, guidelines for interpreting ABA results by evaluating sulfide sulfur content, paste pH, and NPR (Price et al., 1997) are shown on Table 3-5 and demonstrate the following:

- Sulfide Sulfur < 0.3% and pH >5.5 indicates “no potential for acid generation”;

  - As indicated above, six of the seven samples collected indicated sulfide sulfur ranging from 0.03 % to 0.24%, however, the pH of these six samples ranged from 4.8 to 5.5.
- Sulfide Sulfur > 0.3%, pH <5.5, and NPR <1 indicates "likely to be acid-generating";
  - Only the sample from the lower mill area would fall under these criteria.

In summary the ABA results indicate that the sample from the lower mill poses a higher risk of acid-generation than the other AOCs at the Site. However, the results from the previous investigation of the MTA1 soils and tailings using the Synthetic Precipitation Leaching Procedure (SPLP) indicate that potential leaching of metals (specifically lead) would be of concern at the Site. Although the lower mill soils were not subjected to SPLP testing, comparison of the metals and ABA results indicate that the lower mill area may represent worst-case conditions at the Site.

3.6.5 Soil Nutrient Results

As indicated above, soil nutrient analyses were performed to evaluate current levels of organic matter and soil macronutrients (nitrogen, phosphorous, and potassium). These results summarized in Table 3-6 provide background data regarding sitewide soil quality for evaluation of possible organic amendments required for site reclamation. The following observations are included regarding soil nutrient results (Appendix C):

- pH values were generally lower than the paste pH results described above under the ABA analyses; soil nutrient pH ranged from 3.4 at the lower mill area to 4.9 at the upper mill area; the potential repository area indicated a pH of 6.0, which would theoretically represent background pH for topsoil unaffected by Site contaminants;
- Electrical conductivity (EC) results indicate that the highest EC was observed at the lower mill (1.6 mmhos/cm) and MTA1 (0.9 mmhos/cm); however, all samples would be considered "non-saline" and satisfactory for crops (Smith and Doran, 1996);
- Organic matter content ranged from 3.4% in the lower mill area to 7.7% in the MTA2 area, while the organic matter at the potential repository area was 7.9%; in general, organic matter of agricultural topsoil is in the range of 1% to 6%, according to Sustainable Agriculture Research and Education (SARE, 2018).
- Nitrate-nitrite levels are generally low, or less than 10 parts per million (ppm), except for the upper washout area (10.6 ppm) and the MTA2 area (12.7 ppm), which are considered moderate. Nitrate-nitrite above 20 ppm would have enough available nitrogen to meet immediate crop needs (USDA-NRCS, 2014);
- Phosphorus levels ranged between 7.3 ppm (lower mill) to 28.5 ppm (upper mill) and are considered in the medium range for plant growth (Horneck et al. 2011);
- Potassium levels ranged in the low- to medium- range (19 ppm at the lower mill area to 149 ppm at the LWA2 area), while the topsoil from the potential repository area (300 ppm) may be considered in the high range (Horneck et al. 2011); and
- Concentrations of zinc, manganese, and copper from the soil nutrient analysis indicate that these metals are elevated, as would be expected in the historical mill and tailings

areas. Conceivably the metals concentrations would need to be removed or reduced as part of the removal action to facilitate plant growth.

3.6.6 Water Quality Measurements in Trail Creek

AI performed water quality measurements at three locations in Trail Creek during surface water sampling at sampling locations FHM-TC-SWSD-001, FHM-TC-SWSD-002, and FHM-TC-SWSD-003 as shown on Figure 3-5. The results are provided in Table 3-7 and summarized below:

- Temperature ranged from 3.4 degrees Celsius (°C) to 3.7 °C;
- Dissolved oxygen ranged from 9.17 milligrams per liter (mg/L) to 9.64 mg/L;
- Specific conductance ranged from 57.8 microSiemens per centimeter (µS/cm) to 79.6 µS/cm; and pH ranged from 6.7 at FHM-TC-SWSD-001 to 8.09 at FHM-TC-SWSD-003.

3.7 Deviations from the SAP

All samples were collected in accordance with the SAP and the accompanying Standard Operating Procedures (SOPs) outlined within. Deviations from the SAP were based on observations of conditions made by the field team and are described below:

- The SAP specified collection of one composite soil sample from the Upper Washout Area. Field observations of the area indicated a thin layer of visible tailings at the surface in localized areas in the upper, or southwest portion of the Upper Washout Area near NFSR 748. The tailings were observed less frequently downstream of this area, and the central and lower portions of the Upper Washout Area appeared less contaminated and more vegetated than the upper portion. Therefore, the Upper Washout area was separated into two AOCs identified as UWA1 (upper) and UWA2 (lower), and one composite sample was collected from each area.
- Based on the observations above in UWA1, an exception was made to the sampling depth specified in the SAP. The following conditions were observed in collecting the samples for soil/surface tailings:
  - Surface tailings were sporadic and localized in UWA1 and readily-identified by appearance and texture (buff-white to yellowish-orange, very fine-grained with chalky texture);
  - At five of the six sample locations in UWA1, the surficial tailings were distinguished to be less than 6-inches thick, and generally varying from 2- to 3-inches thick;
  - For purposes of characterizing “worst-case” conditions, the samples collected where tailings were less than 6-inches thick were “skimmed” with a hand trowel to isolate the tailings material, and therefore the samples at these locations were not collected to full 6-inch depth per the SAP (AI, 2018a); and
  - All remaining soil samples collected from the other AOCs identified in the SAP were collected from 0- to 6-inch depth as specified.

Other than the deviations noted above, standard field methods were performed in accordance with SOPs to reduce data variability associated with field contamination or sampling error. As identified in the SAP, these included:

- Properly cleaning sampling equipment;
- Maintaining, cleaning, and calibrating field equipment per manufacturer's instructions;
- Using proper field sample collection techniques;
- Collection of appropriate duplicates and laboratory QA/QC samples;
- Processing and compositing soil samples;
- Correctly labeling and transcribing sample data; and
- Properly preserving, handling and shipping samples.

3.8 Nature and Extent of Contamination

3.8.1 Soil/Tailings Samples

The seven composite metal surface soil sample results collected in October 2018 from the FMU, FML, MTA2, UWA1, UWA2, LWA1, and LWA2 and the composite soil sample from MTA1 , FH-TL-1 (HRL, 2012) were compared to the background metal surface soil concentrations, FH-BKG-SED (HRL, 2012) and the results are presented in Table 3-8 and on Figures 3-8 and 3-9. Summary statistics for the soil samples are presented on Table 3-9. Laboratory data packages are provided in Appendix D. In these tables, "X" values in the background exceedance column indicate that the metal result is greater than the background result. Sample FHM-UA-SS-01 is the duplicate of FHM-MTA2-SS-001, representing MTA2.

Initial constituents of potential concern (COPCs) for soil/tailings were determined by comparing the AOC results to background results as summarized below.

Metal	Minimum (mg/kg)	Location of Minimum	Maximum (mg/kg)	Location of Maximum	% Exceeding Background
Antimony	4.57	LWA1	216	MTA1	100% (7/7)
Arsenic	6.47	LWA1	135	MTA1	100% (7/7)
Cadmium	19.2	LWA1	263	FML	100% (7/7)
Chromium	2.47	FML	14.6	LWA1	43% (3/7)
Copper	64.4	LWA2	290	FML	100% (7/7)
Iron	13,000	FML	21,000	LWA2	43% (3/7)
Lead	496	LWA1	14,200	MTA1	100% (7/7)
Manganese	123	FML	602	LWA1	43% (3/7)
Mercury	0.0594	LWA1	6.44	FML	100% (7/7)
Nickel	1.21	FML	10.4	LWA2	43% (3/7)
Selenium	0.817	LWA2	3.0	MTA1	43% (3/7)
Silver	3.28	LWA1	94.2	FML	100% (7/7)
Zinc	678	LWA1	29,800	FML	100% (7/7)

mg/kg – milligrams per kilogram

The following trends were noted in determining COPCs that should be addressed further:

- Antimony, arsenic, cadmium, copper, lead, mercury, silver and zinc exceeded background concentrations in all seven composite samples, indicating that these metals are OPCs for risk assessment;
- Chromium, iron, manganese, nickel exceeded background concentrations only in AOCs that are downgradient and least impacted by the mill tailings (UWA2, LWA1 and LWA2), indicating that these metals are not COPCs for risk assessment; and
- Selenium was detected in less than 50% of samples and is not considered a COPC at this time.

3.8.2 Trail Creek Sediment Samples

Three discrete sediment samples were co-collected with surface water samples. FHM-TC-SD-001 was collected as a background sample. FHM-TC-SD-002 was collected adjacent to FML along with duplicate sample FHM-TC-SD-004. FHM-TC-SD-003 was collected downgradient of FML and adjacent to MTA2. Laboratory data packages are provided in Appendix D.

Sediment samples generally consisted of coarse sands and small gravel. Fine materials were not observed in the sediments. Due to the proximity of the FML to Trail Creek, it is likely that fine tailings (clay and silt) from the lower mill tailings pile are washed into Trail Creek during periods of high local rainfall and are then washed down stream during heavy flow periods in Trail Creek. Sediment sampling results are presented in Table 3-10 and in Figure 3-10. Summary statistics are presented in Table 3-11.

Initial COPCs for sediments were determined by comparing the AOC results to background results as summarized below.

Metal	Minimum (mg/kg)	Location of Minimum	Maximum (mg/kg)	Location of Maximum	% Exceeding Background
Antimony	<0.75	All	<0.75	All	0% (0/3)
Arsenic	<0.46	All	<0.46	All	0% (0/3)
Cadmium	0.118	SD-001	3.91	SD-004	100% (3/3)
Chromium	2.37	SD-003	14.6	SD-004	66% (2/3)
Copper	0.761	SD-001	1.98	SD-004	66% (2/3)
Iron	3720	SD-001	7,010	SD-004	100% (3/3)
Lead	1.42	SD-001	14.8	SD-003	100% (3/3)
Manganese	123	SD-003	173	SD-001	0% (0/3)
Mercury	<0.0028	All	<0.0028	All	0% (0/3)
Nickel	1.48	SD-003	2.54	SD-004	33% (1/3)
Selenium	<0.62	All	<0.62	All	0% (0/3)

Metal	Minimum (mg/kg)	Location of Minimum	Maximum (mg/kg)	Location of Maximum	% Exceeding Background
Silver	<0.123	All	<0.123	All	0% (0/3)
Zinc	16.2	SD-001	161	SD-004	100% (3/3)

mg/kg – milligrams per kilogram
SD-001 – Upgradient from the mill (background)
SD-002 and duplicate SD-004 - Adjacent to the mill site.
SD-003 - Downgradient from MTA2

Cadmium, chromium, copper, iron, lead, nickel and zinc are considered COPCs for sediments and will be evaluated further.

3.8.3 Trail Creek Surface Water Samples

Three discrete surface water samples were collected from Trail Creek. FHM-TC-SW-001 was collected as a background sample. FHM-TC-SW-002 was collected adjacent to FML and adjacent to MTA2 along with duplicate sample FHM-TC-SW-004. FHM-TC-SW-003 was collected downgradient of FML and MTA. Tables 3-12 and 3-13, and Figures 3-11 and 3-12 show the locations and results of the total metals and dissolved metals analyses, respectively. Statistical summaries are presented in Tables 3-14 and 3-15. Laboratory data packages are provided in Appendix D.

When samples were collected in October 2018, measured field turbidity of samples was generally low. Combined with the sampling data, field observations and the similarity between the dissolved metals and total recoverable metals results demonstrate that the majority of metals are likely in the dissolved phase.

Initial dissolved COPCs for surface water were determined by comparing the AOC results to background results as summarized below.

Metal	Minimum (mg/kg)	Location of Minimum	Maximum (mg/kg)	Location of Maximum	% Exceeding Background	%D (BKG-Max) BKG
Antimony	<0.0077	All	<0.0077	All	0% (0/3)	0%
Arsenic	<0.0064	SW-001, SW-002, SW-003	0.00726	SW-004	33% (1/3)	-13%
Cadmium	<0.0007	All	<0.0007	All	0% (0/3)	0%
Chromium	<0.0018	SW-001, SW-002, SW-004	0.00184	SW-003	33% (1/3)	-2%
Copper	<0.007	SW-001, SW-002, SW-004	0.02	SW-003	33% (1/3)	-186%

Metal	Minimum (mg/kg)	Location of Minimum	Maximum (mg/kg)	Location of Maximum	% Exceeding Background	%D (BKG-Max) BKG
Iron	0.415	SW-002	0.464	SW-003	66% (2/3)	-3%
Lead	<0.002	All	<0.002	All	0% (0/3)	0%
Manganese	0.00983	SW-002	0.014	SW-003	33% (1/3)	-9%
Mercury	<0.000049	All	<0.000049	All	0% (0/3)	0%
Nickel	<0.0058	All	<0.0058	All	0% (0/3)	0%
Selenium	<0.0076	All	<0.0076	All	0% (0/3)	0%
Silver	<0.0027	All	<0.0027	All	0% (0/3)	0%
Zinc	<0.0034	SW-004	0.0121	SW-002	33% (1/3)	-7%

mg/kg – milligrams per kilogram
SW-001 – Upgradient from the mill (background)
SW-002 and duplicate SW-004 – Adjacent to the mill site.
SW-003 – Downgradient from MTA2

In summary, the only metals that significantly exceeded background concentrations in surface water were arsenic in SW-004 (%D of -13%) and copper in SW003 (%D of -186%). Arsenic and copper are COPCs in surface water that will be evaluated further.

3.8.4 Laboratory Data Review Report

Pace Analytical Laboratory conducted the chemical analyses for preliminary constituents of concern and provided USEPA Level 3 data packages for data review. These laboratory packages are provided as Appendix D. A summary of the data validation parameters is provided as Appendix E. All data was determined to be useable for risk assessment.

4. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Investigative or clean-up actions taken by the USFS under the authority of CERCLA must be consistent with the National Contingency Plan (NCP), 40 CFR Part 300. Section 300.415(j) of the NCP requires that fund-financed removal actions under CERCLA Section 104 and removal actions pursuant to CERCLA Section 106 shall attain ARARs under Federal or State environmental laws or facility siting laws. Potential ARARs for the removal actions at the Forest Hill Mill and Washout Area are identified and summarized in Table 4-1. These requirements are applicable to the practicable extent dictated by the circumstances of the situation.

ARARs are derived from both federal and state laws. The definitions of "applicable" or "relevant and appropriate" requirements are found in the NCP, 40 CFR Part 300.5. "Applicable" requirements apply to cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. "Relevant and appropriate" requirements refer to cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site to attain goals protective of human health and the environment. A requirement must be both relevant and appropriate, which is determined based on best professional judgment.

ARARs are divided into three categories: chemical-specific, action-specific, and location-specific.

Chemical-Specific ARARs are usually health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish an acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment. Examples include Federal Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act (SDWA), or State cleanup levels for soil. Chemical-specific risk-based health standards are criteria used in the focused human health and ecological risk evaluations presented in Section 5 of this report.

Location-Specific ARARs are restrictions on concentrations of hazardous substances or the conduct of response activities solely because the specific locations are of environmental importance (e.g., federal and state siting laws for hazardous waste facilities on the National Register of Historic Places, wetlands, floodplains, wilderness areas).

Action-Specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular activities that are selected to accomplish a remedy (e.g., capping, excavation, or

pretreatment standards for discharges to a publicly owned treatment works under the Clean Water Act (CWA).

To Be Considered (TBC) criteria are addressed occasionally when ARARs are not sufficient to protect public health and the environment. When this occurs, non-promulgated standards, criteria, guidance, and advisories issued by federal or state government must be evaluated along with the chosen ARARs to help provide protective target cleanup levels and to develop CERCLA remedies. These types of non-promulgated standards are referred to as TBC requirements and are not legally binding, and do not have the status of potential ARARs.

As indicated above, ARARs for the Forest Hill Mill and Tailings Washout are summarized in Table 4-1.

5. STREAMLINED RISK EVALUATION

5.1 General Approach

A streamlined risk evaluation was completed at the Site, generally following current USEPA guidance for human health (USEPA, 1989) and ecological (USEPA, 1997) risk assessments. The screening level approach was designed to be implemented where data are limited and used to evaluate relative risk associated with removal actions in accordance with CERCLA. This screening level approach focuses on metals that were identified in HRL (2012) and further narrowed by comparison to background concentrations identified in surface soil, sediments and surface water in Section 3.8 of this report. Background metal concentrations were established by limited sampling of surface soil, Trail Creek surface water, and Trail Creek sediments from locations upgradient of the former mill and tailings. Background surface soil data was collected by HRL (2012) as a composite sample (FH-BKG-SED) of six sample locations. The general location of these samples is provided in Figure 2-3. The location of background surface water and sediment samples (TCSWSD001) is provided in Figure 3-5.

In this streamlined approach, environmental sample results associated with mine tailings in surface soil, Trail Creek surface water, and Trail Creek sediments were compared to established risk-based screening levels (RBSLs) for human and ecological receptors. Metals with results that were less than the RBSLs are not considered contaminants of concern (COCs) for that media. Metals results that exceeded RBSLs were considered COCs, and areas were prioritized for removal action by the relative amount that RBSLs were exceeded. This approach does not address impact to groundwater because groundwater is not accessible in the general site vicinity at the site at this time; however, SPLP results from tailings samples (HRL, 2012) indicate leaching to groundwater should be considered in the alternatives analysis.

5.2 Problem Formulation

The Site is located in Taylor Park, Colorado, a popular and highly accessible recreation area in the Gunnison NF. Recreational activities include camping, all-terrain vehicle riding, fishing and river rafting. Taylor Park is habitat to a wide variety of wildlife including possible habitat for threatened and endangered species. Tailings from the former mill are known to contain elevated concentrations of metals that are toxic to human and ecological receptors under certain concentrations and exposure parameters. Tailings at all AOCs are accessible to campers, hikers and terrestrial ecological receptors which use the area for habitat. In addition, metals may be transported into Trail Creek or adjacent habitats via transport pathways. Figure 5-1 provides a graphical depiction of the sources of potentially toxic metals, transport pathways, and potential receptors that will be evaluated in the stream-lined risk evaluation. Figure 5-2 provides a schematic description of these inter-related mechanisms.

The primary sources of contamination include the remnant tailings and the upper and lower washout areas located downstream of the tailings. The former mill area was evaluated and identified as the location of the highest concentrations of COPCs in tailings, with the most likely

complete pathway to the Trail Creek ecosystem. Potential pathways of contaminant migration include surface runoff to nearby downstream soil and surface water as observed in the washout areas (MTA2, UWA1, UWA2, LWA1, and LWA2).

Contaminants in air due to generation of fugitive dust were not measured. In general, the FMU, FML, MTA1, UWA1, LWA1 and LWA2 were poorly vegetated during the investigation which took place in October 2018. During the investigation, fine yellow to light brown silts and fine sands associated with maximum COPC concentrations were observed in the surface soils of FML, MTA, and UWA AOCs, and as a very thin veneer at LWA1 and LWA2. These fine silts and sands are expected to be mobile in high winds during the dry summer months, though these soils were moist during the field effort in October and were not airborne. The airborne pathway is expected to be seasonal, highly variable, and may be exacerbated by recreational vehicle traffic.

The study area consists of four primary source areas:

1. The Former Mill, which was partitioned into FMU and FML, based on observed quantity and thickness of tailings;
2. The Main Tailings Area, which was partitioned into MTA1 and MTA2, based on observed quantity and thickness of tailings;
3. The Upper Washout Area, which was partitioned into UWA1 and UWA2, based on observed quantity and thickness of tailings; and
4. The Lower Washout Area, which was partitioned into LWA1 and LWA2, based on observed use. LWA1 included parking and camp locations, including fire pits.

COPCs are potential contaminants that are above established background concentrations. COPCs were determined to be mill-related metals in tailings, notably antimony, arsenic, cadmium, total chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, zinc.

Preliminary receptors include human campers and site visitors and ecological receptors that use the site for habitat.

5.3 Risk Assessment Approach

This streamlined risk evaluation was completed to identify environmental media impacted by mine waste above risk-based screening standards and identify where this waste is most likely to present an exposure and migration threat to onsite and offsite human and ecological receptors. This screening-level approach was designed for sites with limited data sets to evaluate relative risk associated with COPCs to determine if risks are acceptable or if removal actions are necessary to lower the risks to acceptable levels.

5.3.1 Identification of Media of Concern (MOC)

The primary media of concern are:

1. Soil (tailings) associated with the FMU, FML, MTA1, MTA2, UWA1, UWA2, LWA1 and LWA2;
2. Surface water associated with Trail Creek in the vicinity of the AOCs in item 1; and
3. Sediment associated with Trail Creek in the vicinity of the AOCs in item 1.

Tailings at the former mill site and AOCs downgradient are available for direct contact, inhalation and ingestion for recreational visitors and ecological receptors. The surface water of Trail Creek is available for mammal and bird ingestion, and therefore is a MOC for terrestrial receptors, as well as aquatic receptors. It is also a potential source of drinking water and washing water for onsite campers or hikers.

5.3.2 Risk Screening Methodology

Multi-media environmental samples were collected in two field efforts using a composite sample methodology approach. In this approach, five or more samples of soil from potential tailings were collected from each of the eight AOCs (FML, FMU, MTA1, MTA2, UWA1, UWA2, LWA1, and LWA2) and each set of samples were composited into a homogenized composite sample that represented the AOC for laboratory analysis. COPCs at the site are metals from tailings piles resulting from milling ore at the Site. The results from each composite sample are compared to RBSLs to identify which AOC exceed screening levels and to document the relative amount of those exceedances.

5.3.3 Human Receptor Risk-Based Screening Levels

AI conducted a streamlined human health risk assessment using the BLM Recreational Camper exposure scenario (Cox, 2017) and exposure parameters as the most likely human receptor; and the USEPA Residential and Industrial exposure scenarios and associated exposure parameters (USEPA, 2018b) as more conservative scenarios for comparison purposes. The use of the more conservative exposure parameters also provides insight into how the material can be used if transported offsite for fill material. Table 5-1 presents the RBSLs that were used for human health screening.

The BLM Recreational Camper exposure scenario uses the same exposure parameters as the USEPA residential exposure scenario, except the annual exposure frequency is limited to 14 days per year, which is the amount of time a camper is allowed to camp in a single location within the National Forest or on BLM lands (Cox, 2017).

The USEPA Residential exposure scenario is described in detail in USEPA (1989; 2018b) guidance and assumes childhood through adulthood at the same residence. The exposure frequency for both children and adults is 350 days per year. Additional exposure parameters are provided in the USEPA (2018c).

The USEPA Industrial exposure scenario is described in detail in (USEPA, 2018c) as a long-term adult receptor exposed during the work day who is a full-time employee working on-site and

spends most of the workday conducting maintenance activities outdoors. The composite worker uses an exposure frequency of 250 days/year, and other default exposure parameters are listed in USEPA (2018c).

5.3.3.1 Surface Soil Concentrations Compared to RBSLs

Table 5-2 presents the metal results in surface soil for each AOC compared to the RBSL's described above. In Table 5-2, concentrations that exceed RBSLs are shown in red. The most relevant RBSL is the BLM Recreational Camper RBSL.

At the former mill area:

- At FML, lead exceeds the BLM RBSL by a factor of 10, and arsenic exceeds the carcinogenic RBSL by a factor of 2; and
- At FMU, lead is equal to the BLM RBSL, and arsenic is less than carcinogenic RBSL.

At the Main Tailings Area:

- At MTA1 (FH-TL-1), lead exceeds the BLM RBSL by a factor of 18, and arsenic exceeds the carcinogenic RBSL by a factor of 4.; and
- At MTA2, lead exceeds the BLM RBSL by a factor of 4, and arsenic is approximately equal to the carcinogenic RBSL.

At the Upper Washout Area:

- UWA1, lead exceeds the BLM RBSL by a factor of 6, and arsenic exceeds the carcinogenic RBSL by a factor of 2; and
- UWA2, the lead concentration is approximately equal to the BLM RBSL, and arsenic does not exceed the carcinogenic RBSL.

At the Lower Washout Area, neither BLM RBSLs nor carcinogenic RBSLs are exceeded.

The only COC for the BLM Recreational Camper exposure scenario is lead, which exceeds the background result (16 mg/kg) in all AOC samples and exceeds the BLM SL at all AOCs except the Lower Washout Area (LWA1 and LWA2). Arsenic exceeds the threshold carcinogenic RBSL at FML, MTA1 and UWA1, but falls within the risk management decision-making range for these AOCs.

5.3.3.2 Surface Water Concentrations compared to RBSLs

This section the results in surface water samples located adjacent to the mill site (FHM-TC-SW-002) and downgradient of MTA2 (FHM-TC-SW003) compared to the EPA Tap water RSLs and Regulation 11: Colorado Primary Drinking Water Regulations (5 CCR 1002-11). Both of these standards are specific to drinking water sources, which is very conservative compared to the

expected human exposure to Trail Creek surface water; however, comparisons would identify metals that may require more detailed review. Water results for total and dissolved are included in Tables 5-3 and 5-4. These results are also presented on Figures 5-5 and 5-6.

Based on comparison to water quality upgradient of the mill site represented by surface water sample FHM-TC-SW001, only dissolved arsenic in the duplicate water sample (FHM-TC-SW004-D, 0.00726 mg/L J, adjacent to the FML) and dissolved copper in the downgradient sample (FHM-TC-SW-003-D, 0.02 mg/L J, adjacent to MTA2) exceed the background concentrations at FHM-TC-SW001 (arsenic, <0.0064 mg/L; and copper <0.007 mg/L).

Arsenic is a carcinogen, therefore, the concentration at FHM-TC-SW004 compared to the USEPA RSL presents a LTCR of 1×10^{-4} if the water were to be used for residential potable water. Arsenic at FHM-TC-SW004 also exceeds the Colorado standard (0.0002 mg/L) by a factor of 36.

The USEPA RSL for copper in tap water (November 2018) is 0.8 mg/L, the USEPA MCL is 1.3 mg/L, and the Colorado standard (5 CCR 1002-11) is 1 mg/L. The detected copper concentration that exceeded background in FHM-TC-SW003 was 0.02 mg/L, which did not exceed any potable water standards described above.

Based on this evaluation, the arsenic concentration at FHM-TC-SW004, adjacent to FML, is unacceptable for potable water use under residential tap water exposure criteria. This exposure is much greater than the anticipated BLM Recreational Camper exposure.

5.3.4 Streamlined Ecological Risk Evaluation

AI evaluated site-specific receptors by first identifying potential Threatened and Endangered Species (T&E species) with the potential to use the study area as a habitat. AI screened the area for T&E species using the United States Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) website (USFWS, 2018) for the Forest Hill study area (see Appendix F). Table 5-5 includes the T&E mammals, birds, fish, insects, and flowering plants that may use this area but did not identify the study area as a critical habitat for any of these T&E species identified by the IPaC website. These were:

- Mammals – Canada Lynx (*Lynx canadensis*) and North American Wolverine (*Gulo gulo luscus*);
- Birds – Gunnison Sage-grouse (*Centrocercus minimus*); and
- Fish – Bonytail Chub (*Gila elegans*), Colorado Pikeminnow (squawfish) (*Ptychocheilus lucius*), Greenback Cutthroat Trout (*Oncorhynchus clarkii stomias*), Humpback Chub (*Gila cypha*), Razorback Sucker (*Xryauchen texanus*).

According to IPaC, the study area for the Site is not within the critical habitat for any of these T&E or migratory species.

5.3.4.1 To Be Considered Ecological Risk Standards for Terrestrial Receptors

To evaluate potential impact on these species in the ecological risk assessment, AI used risk-based standards from the United States National Park Service (NPS, 2016), Ecological Screening Values (ESVs) for terrestrial receptors.

- Birds and Mammals (B&M) was used (NPS, 2016). ESVs for the protection of birds and mammals from contaminants in soil/sediment were chosen by the NPS from several sources specifically approved for use at NPS sites.
- Plants and Invertebrates (P&I) identifies ESVs for exposures of terrestrial plants and soil invertebrates from direct contact with soil were chosen by the NPS from several sources specifically approved for use at NPS sites.

ESV sources used by the NPS in deriving the NPS ESVs (lowest acceptable screening value, chemical-specific) (NPS, 2016) include:

- Ecological Soil Screening Level (Eco-SSLs) (USEPA, 2005): Minimum across species of birds and mammals evaluated in source.
- Los Alamos National Laboratory (LANL) no adverse effect level (NOAEL) (LANL, 2010): Minimum across species of birds and mammals evaluated in source.
- Toxicological Benchmarks for Wildlife food-based value (Sample, Opresko, & Suter II, 1996): Minimum across species of birds and mammals.
- Oak Ridge National Laboratories (ORNL) Toxicological Benchmarks: Toxicity of contaminants in soil to a wide range of plants, soil invertebrates (including earthworms), and microbes and determined the lowest observed effect concentration (LOEC) for each.

RBSL ESVs are shown in Table 5-6 and the Table Value Standards (TVS) coefficients are shown in Table 5-7.

5.3.4.1.1 Surface Soil Risk Screening for Terrestrial Ecological Receptors

Table 5-8 presents the screening metal results in surface soil for each AOC compared to the RBSL's described above, for terrestrial ecological receptors. Based on a preliminary comparison to background concentrations in soil represented by sample FH-BKG-SED (six samples composited from an upgradient background location), collected in 2010 (HRL, 2012), antimony, arsenic, cadmium, copper, lead, mercury, silver and zinc are COPCs because they exceed background concentrations in AOC surface soil samples as presented in Table 3-6. Based on a review of Table 5-8, the following information is noted:

At the former mill:

- FML, antimony, cadmium, lead, mercury and zinc exceed their B&M RBSLs by a range of 419 to 759 times; and
- FMU, the cadmium and lead exceed their B&M RBSLs by a range of 56 to 85 times.

At the Main Tailings Area:

- MTA1, antimony, cadmium, lead, mercury and zinc exceed their B&M RBSLs by a range of 169 to 1,291 times; and
- MTA2, antimony, cadmium, lead, mercury and zinc exceed their B&M RBSLs by a range of 26 to 283 times.

At the Upper Washout Area:

- UWA1, antimony, cadmium, lead, mercury and zinc exceed their B&M RBSLs by a range of 72 to 446 times; and
- UWA2, antimony, cadmium, lead, mercury and zinc exceed their B&M RBSLs by a range of 47 to 118 times.

At the Lower Washout Area:

- LWA1, antimony, cadmium, lead, mercury and zinc exceed their B&M RBSLs by a range of 15 to 53 times; and
- LWA2, antimony, cadmium, lead, mercury and zinc exceed their B&M RBSLs by a range of 19 to 64 times.

Surface soil sample from the lower mill area and the main tailings area indicate these AOCs represent the largest ecological risks. Antimony, cadmium, mercury, and zinc represent the main COC risk drivers. Birds and mammals are the receptors that are potentially most adversely affected by these COCs in the study area.

5.3.4.2 To Be Considered Sediment Ecological RBSLs for Benthic Receptors

The NPS freshwater sediment Screening Level Ecological Risk Assessment (SLERA) ESVs are limited to arsenic, cadmium, copper, chromium, iron, lead, manganese, mercury, nickel and zinc. These are based on the lowest standard from NPS-accepted ecological toxicology studies, including:

- MacDonald, Consensus-Based Sediment Quality Guidelines (Macdonald et al., 2000); and
- Ingersoll, Sediment Effect Concentrations from the Assessment and Remediation of Contaminated Sediments (ARCS) Program (Ingersoll et al., 1996).

5.3.4.2.1 Sediment Risk Screening for Freshwater Benthic Receptors

As described in Section 3.6.3, cadmium, chromium, copper, iron, lead, manganese and zinc exceeded background sediment concentrations represented by sample FHM-TC-SD-001, in one or both of the downgradient sediment samples. Table 5-9 provides the risk screening

comparisons RBSLs for freshwater benthic receptors that may be exposed to these sediments. In general, the sediment risk screening indicated that potential ecological adverse effects from sediments are low. The sediment result for cadmium at location FHM-TC-SED-002 adjacent to the mill site had the highest potential for adverse effect and was equal to the ecological RBSL.

5.3.4.3 To Be Considered Surface Water Ecological RBSLs for Aquatic Receptors

The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission (WQCC) implements these requirements through Regulation No. 31, The Basic Standards and Methodologies for Surface Water [5 Colorado Code of Regulations (CCR) 1002-31]. This regulation is intended to implement the CWA by maintaining and improving the quality of the state surface waters. This regulation is based on the best available knowledge to insure the suitability of Colorado's waters for beneficial uses including public water supplies, domestic, agricultural, industrial and recreational uses, and the protection and propagation of terrestrial and aquatic life. It is further intended to be consistent with the 1983 and 1985 goals and objectives of the CWA. The Taylor River watershed is regulated in accordance with its association and location within the Gunnison River Basin. Gunnison River Basin water quality standards are documented in Regulation No. 35, Classifications and Numeric Standards for Gunnison and Lower Dolores River Basins (5 CCR 1002-3). Regulation No. 35 appendices present numeric standards for non-metallic inorganic compounds, physical and biological components, and metals in surface water. Metals and other inorganic component standards are provided as acute standards and chronic standards and dissolved and total recoverable in surface water. These standards are both numeric, and as TVS that are a function of surface-water hardness. Table 5-7 provide the function coefficients for hardness specific TVS values provided in this report, as defined by Regulation No. 35.

5.3.4.3.1 Surface Water Quantitative Risk Screening for Freshwater Aquatic Receptors

Tables 5-10 and 5-11 present the ecological risk screening comparison to RBSLs for surface water in Trail Creek adjacent to the Site for both total and dissolved metals. As described in Section 3.6.3, based on comparison to dissolved water quality upgradient of the mill site represented by surface water sample FHM-TC-SW001, only arsenic in the duplicate water sample (FHM-TC-SW004, 0.00726 mg/L J, adjacent to the FML) and copper in the downgradient sample (FHM-TC-SW003, 0.02 mg/L J, adjacent to MTA2) exceeds the background concentrations at FHM-TC-SW001 (arsenic, <0.0064 mg/L; and copper <0.007 mg/L).

- Arsenic in FHM-TC-SW004 (0.00726 mg/L) did not exceed Colorado TVS (0.15 mg/L), or the risk-based SLERA EVS (0.05 mg/L) and is not considered a COC for this sampling event; and
- Copper in FHM-TC-SW003 (0.02 mg/L) exceeded Colorado TVS (0.0023 mg/L) by a factor of 9.

Although surface water sampling represents a point in time result, copper should be considered a COC for further evaluation in surface water adjacent to MTA2 in Trail Creek, due to potential effects to freshwater ecology.

6. INDENTIFICATION OF REMOVAL ACTION SCOPE AND GOALS

Identifying the scope and goals for a removal action is a critical step in the EE/CA and in the conduct of non-time-critical removal actions. In general, the scope, goals and objectives of a removal action under CERCLA are set to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or threat of release that is an unacceptable threat to human health or the environment.

The goal of the removal action at the Site, includes limiting the effects of contaminated Site soils and tailings to recreational visitors and the surrounding environment. The objectives of the removal action are to:

1. Reduce the exposure of human and ecological receptors to COCs identified in mine tailings evaluated in this study;
2. Control contaminant source areas (soil and tailings) from migration to nearby surface water or other media/areas;
3. Limit the migration of tailings via air and surface water and other surface transport mechanisms; and
4. Restore/revegetate disturbed areas with native vegetation to minimize erosion.

7. IDENTIFICATION AND COMPARISON OF REMOVAL ACTION ALTERNATIVES

This section addresses the following key items: (1) identifies potential removal action technologies to be considered (2) identifies and presents the criteria for selecting the most appropriate removal action alternatives, and (3) identifies and presents an analysis of the selected/implementable removal action alternatives.

Due to the nature of the MOCs and COCs (metals and metallic minerals in surface soil, tailings and/or sediments and surface water in Trail Creek), there are a limited number of alternatives associated with this analysis of alternatives. There is no treatment technology to destroy COCs to reduce volume. The objectives will be to minimize exposure to human end ecological receptors, to reduce the toxicity by stabilizing metallic minerals, and reduce the potential to migrate to offsite receptors through stabilization. The USFS standard practices for mine sites are to consider presumptive remedies and, if necessary, removal action alternatives that do not require long term operations and maintenance.

7.1 Description of Removal Action Technologies

This section identifies applicable technologies, based on site conditions and COCs. Only those technologies proven to be effective at similar sites were evaluated during the EE/CA technology screening process. The following technologies were selected for further development and possible implementation during evaluation of the removal action alternatives:

- On-site Repository;
- Off-site Repository;
- Covering in-place with infiltration controls;
- In-Situ Stabilization;
- Surface Controls; and
- Institutional Controls.

7.1.1 On-Site Repository

An on-site repository is not designed to reduce the volume or toxicity of hazardous materials. It is used to control source material (tailings or contaminated soil) and mitigate migration or further contamination of other media/areas. On-site repositories can be used as a permanent source control measure. The repository design would depend primarily on the contaminant levels and mobility of the material requiring control. This technology generally involves excavating and placing the contaminated materials in an engineered repository located onsite.

An uppermost vegetative layer would be added above the capillary barrier and restored with topsoil and native species. A native vegetative cover would also help to prevent infiltration and erosion. Run-on controls such as rock lined channels are typically designed at the perimeter of

the repository to prevent erosion of the cover and route upgradient stormwater away from the repository.

Repository location criteria used for initial screening include, but are not limited to, the following: general site features (site access, estimated capacity, distance to water bodies, degree of slope), site geology (surficial material, depth to groundwater, slope stability), presence of cultural resources, biological factors (threatened, endangered, or sensitive species), environmental factors (avalanche potential, disturbance areas, wetlands areas).

7.1.2 Off-Site Repository

An off-site repository involves using a similar design as with the on-site repository. The difference being contaminant volume, toxicity, and mobility are either eliminated or significantly reduced at sites because the contaminated material would be hauled off-site. However, the volume and toxicity are then present at the off-site location, which must be similarly evaluated as the onsite location. An off-site repository may be advantageous in that it may be better suited to accommodate certain construction constraints such as volume capacity, depth to groundwater, highly toxic waste, or appropriate soil cap material on-site or nearby.

7.1.3 Capping in Place

Capping material in place involves grading existing contaminant source to eliminate steep slopes followed by covering the mine waste material with a protective layer to reduce contaminant exposure and migration. The protective layer typically consists of a vegetated topsoil layer designed to protect the low permeability layer and to help reduce infiltration through evapotranspiration. Capping in-place is an appropriate alternative for addressing contaminated materials that need to be left in place due to site constraints, or an optimum in-place location.

7.1.4 In-Situ Stabilization

In-situ stabilization could be applied to reduce contaminant mobility, bioavailability, and toxicity of mine wastes using soil amendments such as lime, organic matter and fertilizer. Lime increases soil pH, providing a more hospitable growth environment for vegetation and soil organisms. Lime and organic matter chemically precipitate and/or sequester metals by complexation and sorption mechanisms within the amended soils. Stabilization of contaminants decreases the net flux of metals through the plant/soil/water system leading to decreased contaminant mobility. In-situ stabilization would also be minimally disruptive of the current land use.

7.1.5 Surface Controls

In Surface controls can be integrated with other technologies to minimize migration of contaminants to nearby surface water or other media/areas. Surface control measures are designed to control environmental impacts, such as surface water run-on/run-off over

contaminated materials. These measures typically include grading, vegetation, erosion protection, consolidation, and surface water diversion.

Grading

Grading is used to reduce/reshape slopes for managing surface water run-on/run-off, control erosion, minimize hazards, and contour sites to more natural conditions. Periodic maintenance may be necessary to repair problems associated with settlement and erosion.

Vegetation

Vegetation may involve adding soil amendments to a specific depth to provide nutrients and organic materials for enhancing vegetation growth. At a minimum, selection of the appropriate plant species, preparation of the seeding area, seeding and/or planting, and fertilization are also necessary steps in the vegetation process. Adding neutralizing agents and/or additives to improve pH conditions and/or the water storage capacity of soil may also be required. Vegetation is essential to control water and wind erosion processes and reduce surface water infiltration through evapotranspiration. Periodic maintenance may be required to ensure adequate vegetative establishment and weed control.

Erosion Protection

Erosion protection includes using erosion resistant materials to control and reduce erosional effects at the surface. Typical applications of erosion protection involve installation of natural or synthetic fabric mats, straw waddles, riprap, hay bales, or earthen berms along slopes, or surface water diversion structures.

Consolidation

Consolidation involves placing similar types of wastes together in a common area for more efficient management. Consolidation can be especially appropriate in areas where multiple, smaller contaminant sources are present or in environmentally sensitive areas, such as floodplains.

Surface Water Control Measures

Surface water control measures are implemented to reduce contaminant mobility by limiting water erosion processes. Surface water controls may include drainage channel improvements and relocation or diversion of surface water run-off around potentially contaminated areas. One approach may include use of surface water management systems (also referred to as run-on and run-off control measures) which diverts stormwater away from the contaminated areas and contaminated mine drainage away from clean or sensitive areas. Vegetation or riprap may be used in the diversion swales and areas of sheet flow to limit the erosion potential.

7.1.6 Institutional Controls

Institutional controls are administrative and/or legal controls that help minimize risk and/or protect the integrity of a remedy by limiting future land use or preventing access to the Site. Examples include deed restrictions to prohibit residential use of the Site and fencing and warning signs to discourage access to the site. While such controls may not effectively achieve cleanup goals, they are often used to augment other removal alternatives.

7.2 Components of the Removal Action Scope

The USEPA NTCRA guidance (USEPA, 1993) identifies that a limited number of alternatives should be selected for detailed analysis. Furthermore, USEPA suggests that only the most qualified technologies that apply to the media or source of contamination should be discussed in the EE/CA. The following technologies were selected for further development and possible implementation during evaluation of the removal action alternatives:

- On-Site Repository with Impermeable Cap;
- Off-Site Repository;
- In-Situ Stabilization;
- Surface Controls; and
- Institutional Controls.

Each of the selected technologies listed above is described in the following subsections. These descriptions provide an overview of their technical application and approach used in the development and assembly of the evaluated removal action alternatives. The following bullets present the limited number of removal action alternatives evaluated in this EE/CA.

- Alternative 1: On-Site Repository with Impermeable Cap and In-situ Stabilization with Amendments, Revegetation
- Alternative 2: Off-Site Repository and In-situ Stabilization with Amendments, Revegetation
- Alternative 3: No Action

The no action alternative is included in this report as a baseline for comparison with other removal action alternatives and is routinely included in EE/CA and feasibility study documents for these purposes. This alternative does not require remediation or removal work. No effort would be made to actively reduce risks to human health or the environment. The Site would remain as it exists today or would further degrade due to outside influences.

7.2.1 Alternative 1: On-Site Repository with Impermeable Cap, and In-situ Stabilization with Amendments, Revegetation

Alternative 1 consists of constructing an on-site repository with an impermeable cap for consolidation of the former mill waste rock and contaminated soil and debris, as well as the

wastes (tailings and/or contaminated soil/sediment) from the AOCs downgradient of the former mill, including the MTA, UWA. In-situ stabilization with amendments and revegetation would occur in areas where tailings are thin, such as LWA, and selected areas throughout the other AOCs.

As indicated in Section 3, potential repository locations at the Site are identified as the terrace deposits that are located to the west and above the lower washout areas. These areas are accessible to NFSR 748 and are located within one mile of the former mill area and other Site AOCs. In addition, the potential repository locations are elevated above the floodplain, appear large and relatively flat, and likely have sufficient capacity for management of the Site wastes. In addition, the potential repository locations are approximately 1,500 feet east of the on-site wetlands area and are separated from the wetlands by a topographic ridge.

The repository design would consist of excavating an on-site cell of sufficient area and depth to accommodate the Site wastes from the former mill and downgradient AOCs. Estimates of the volumes of wastes at the AOCs and the estimated capacity of an on-site repository is provided in Table 7-1. An engineered repository cap, including an impermeable HDPE liner or a GCL would be installed beneath a protective soil cover and capillary barrier to mitigate meteoric water from infiltrating through the repository and mobilizing COCs in leachate. The uppermost vegetative layer would consist of topsoil and re-seeding with native plant species.

The design repository footprint or depth may be enlarged to generate enough volume of backfill for the waste removal areas. A preliminary footprint for the bottom floor of the repository would be 8-feet below the existing grade and approximately 225-feet x 150-feet, with 2:1 side slopes. This preliminary footprint would accommodate the maximum waste volume estimate of 10,000 cubic yards. As part of the removal action design, additional field screening/analysis of the AOCs using X-ray fluorescence (XRF) and paste pH would result in reducing the volume of waste, and also the repository footprint.

The Site wastes would be removed and transported from the former mill and downgradient AOCs to the repository using conventional earth-moving equipment. The wastes would be layered and compacted in the repository to design grades beneath the original existing grade of the terrace deposit, with a design minimum thickness of impermeable cap and vegetative cover over the top of the wastes.

As indicated in Section 2, previous SPLP testing performed at the site indicate that leaching of metals (specifically lead) may be a concern for the Site. Typical abandoned mine sites may require installation of a soil cover; however, the potential for leaching at the Site may require installation of an impermeable cap instead of a soil protective cover.

The impermeable cap overlying the repository wastes may consist of either a high-density polyethylene (HDPE) liner or a composite geosynthetic clay liner (GCL), which would be determined in the design phase for the removal action. GCLs consist of thin layers of processed clay (typically bentonite) placed between geotextiles or bonded onto a geomembrane. GCLs have

been used by themselves as a barrier in liners or covers (MEND, 2002). Typically, the material costs for GCL would be higher than HDPE; however, HDPE typically requires a higher level of labor, QA/QC, and potentially additional costs for preparing a more suitable subgrade beneath the HDPE. Removal action design criteria would be used for USFS to determine the appropriate cap liner material.

In addition, a designed capillary barrier would likely be required over the impermeable HDPE or GCL to prevent accumulation of stormwater (snowmelt and other precipitation) on the liner. A capillary barrier is developed when an unsaturated fine-grained soil layer (e.g., sand or pea-gravel) is underlain by another unsaturated porous material with relatively large-sized pores, such as a coarse-grained layer (gravel), or a porous geosynthetic (e.g. a nonwoven geotextile). The interface or difference in materials enhances the ability of the fine-grained materials to store water (Zornberg, 2010). If the fine-coarse interface is sloped, water in the fine layer can also drain laterally under unsaturated conditions. (Dwyer, 2003). Capillary barriers or breaks have been designed and installed for numerous landfill caps or covers in the US, in climates ranging from arid to humid, and were used extensively in caps and covers overlying hazardous waste at the Rocky Mountain Arsenal, Colorado (Williams et al, 2011)

A functional capillary barrier would prevent stormwater from accumulating over the cap liner or GCL, and in turn prevent excess stormwater from infiltrating the underlying repository wastes. The capillary barrier cover design can be effective in limiting the ingress of both oxygen and water to the underlying waste material (MEND, 2004). However, suitable materials to produce an effective capillary barrier are likely not available at the Site and would likely require importing processed material from a commercial plant or quarry, or a geosynthetics supplier if a geotextile material were selected. The design criteria for the removal action would determine the appropriate materials (coarse gravel or non-woven geotextile) and design thickness required for the capillary barrier. In addition, a protective soil cover generated from the repository soils may be required to be placed on top of the HDPE or GCL liner to protect the liner during installation of the capillary barrier.

The top vegetative cover overlying the capillary barrier would be designed to tie-in to the grade of the surrounding undisturbed terrace deposit, to restore the area to resemble the original terrace deposit. The design for the repository surface will be graded or sloped appropriately to minimize infiltration of surface water into the underlying repository and conform to the surrounding site topography. The upper vegetated topsoil layer would be designed to protect underlying layers and help reduce infiltration. Rock-lined channels or other appropriate drainage controls would be designed and installed to divert surface runoff from the repository perimeter.

On-site consolidation in a repository is not designed to reduce the volume of hazardous materials but would reduce the human and ecological risk associated with exposure to the source of contamination and to limit the potential for off-site contaminant migration. This alternative generally involves:

- Stripping and salvaging topsoil from the proposed repository location;

- Construction of an equipment access road from NFSR 748 to the former mill location;
- Excavating and removing the former mill soil, waste rock and debris to design depth and transporting these materials to the on-site repository;
- Re-shaping, contouring, and benching the former mill area to design grade for proper slope stabilization;
- Reclaim the former mill area with organic topsoil and revegetate with species compatible with the area;
- Excavate tailings and/or contaminated soil to design depth from AOCs downgradient of the former mill (MTA, UWA, and LWA) and transport the wastes to the on-site repository;
- Layer and compact waste materials in the repository per design and overlay with impermeable cap subgrade;
- Install the impermeable cap HDPE membrane or GCL;
- Install soil protective cover over HDPE membrane or GCL, and install overlying capillary barrier;
- Reclaim repository surface to design grade, replace topsoil and revegetate with species compatible with the area; and
- Construct drainage controls per design to divert surface runoff from the repository perimeter and other disturbed areas.

At LWA and in selected areas of the other AOCs, in-situ stabilization of thin tailings with amendments could be applied, including organic material, and pH buffers, such as calcium carbonate, to increase the pH, stabilize residual metals, and allow revegetation. Identification of types and volumes of amendments would require additional testing during the removal design phase of the action. This would include backfilling, regrading and reclaiming these areas with necessary soil amendments to promote revegetation with species compatible with the area.

Additional institutional controls may be added in the form of natural barriers (boulder placement and tree slash to protect near-term growth of vegetation) along the access road to the disturbed areas and the repository. In general, institutional controls do not actively address site contamination, nor do they reduce contaminant mobility. These controls would be applied to restrict or control access to the former AOCs and repository to reduce the potential for human access and ATV access, and potentially enhance the reclamation/restoration of disturbed areas by limiting visitor access.

7.2.1 Alternative 2: Off-Site Repository, In-situ Stabilization with Amendments, Revegetation

An off-site repository involves using a similar design as with the on-site consolidation. Although an off-site repository would reduce the contaminant volume toxicity at the Forest Hill Mill Site, it would still be a concern at the off-site location; therefore, no real reduction of toxicity or volume is gained.

Off-site disposal involves excavating the waste materials and debris for transport to an off-site disposal facility permitted to accept such materials. Off-site disposal options include a nearby,

permitted solid-waste, Resource Conservation and Recovery Act (RCRA) Subtitle D landfill or a distant RCRA Subtitle C permitted facility. Non-Bevill exempt hazardous materials would require disposal in a RCRA Subpart C hazardous waste facility; although, no materials at the site have been identified as such. Less toxic materials and debris could be disposed of in a permitted solid waste Subpart D landfill. However, many Subpart D landfills will not accept mining waste. For purposes of this EECA, the evaluation assumes that the wastes from the Site would be transported for disposal at the 6 Mile Lane Solid Waste Disposal Facility in Gunnison County, Colorado. This facility is the nearest municipal solid waste disposal facility permitted by CDPHE.

For the Forest Hill Mill Site, this technology generally involves:

- Construction of an access road from NFSR 748 to the former mill location;
- Excavating and removing the former mill soil, waste rock and debris to design depth and transporting these materials to the off-Site repository in Gunnison County, Colorado;
- Re-shaping, contouring, and benching the former mill area to design grade for proper slope stabilization;
- Reclaim the former mill area with organic topsoil and revegetate with species compatible with the area;
- Excavate tailings and/or contaminated soil to design depth from AOCs downgradient of the former mill (MTA, UWA, and LWA) and transport the wastes to the off-Site repository; and
- Construct drainage controls per design to divert surface runoff from the repository perimeter and other disturbed areas.

At LWA and in selected areas of the other AOCs, in-situ stabilization of thin tailings with amendments, including organic material, and pH buffers, such as calcium carbonate, to increase the pH, stabilize residual metals, and allow revegetation. Identification of types and volumes of amendments would require additional testing during the removal design phase of the action. This would include backfilling, regrading and reclaiming these areas with necessary soil amendments to promote revegetation with species compatible with the area.

The advantages of an offsite repository are not beneficial when compared to Alternative 1. An off-site repository would be advantageous if the on-site repository location was environmentally sensitive or in an unstable setting. Environmentally sensitive areas include wetlands, locations with near surface groundwater; locations that will likely be affected by future construction; or areas that are zoned for commercial or residential use. Potentially unstable settings include steep hillsides, areas prone to earthquakes, and areas subject to flooding. In addition, off-site repositories should be considered if they are better suited to accommodate certain construction constraints such as volume capacity, highly toxic waste, or the availability of appropriate soil cap materials on-site or nearby. These conditions are not found in the on-site repository location associated with Alternative 1.

Disadvantages of utilizing off-site repositories are especially magnified at the Forest Hill Mill Site: costs associated with transporting the material offsite, difficulties associated with moving

material on the public access roads near Taylor Park, requiring construction traffic control, time associated with transporting the material off-site, and potential regulatory issues associated with acceptance from the proposed landfill.

7.2.2 Alternative 3: No Action

As indicated above, the no action alternative is included in this report as a baseline for comparison with other removal action alternatives. Under this alternative, no effort would be made to actively reduce risks to human health or the environment. No action and leaving the Site as-is would entail:

- The former mill site and downgradient AOCs would remain in their current locations and in their current state;
- The physical hazards associated with steep slope and wood debris at the former mill would remain; and
- The downgradient AOCs (MTA, UWA, and LLWA) remain accessible to recreational visitors, ATV's, and ecological receptors.

7.3 Overview of the Evaluation Criteria for Non-Time Critical Removal Actions

There are three types of criteria against which each alternative is evaluated. These criteria are derived from the Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA (USEPA, 1993). The evaluation criteria include effectiveness, implementability, and cost. Within each primary criterion, EE/CA guidance recognizes a number of factors that help define the primary criteria that should be individually considered. These three evaluation criteria and their additional factors are discussed in detail in the following subsections.

7.3.1 Effectiveness

Effectiveness focuses on the degree to which an alternative (1) provides adequate overall protection of human health and the environment; (2) complies with ARARs; (3) affords long-term protection by minimizing residual risk; (4) provides reduction of toxicity, mobility, or volume of hazardous material; and (5) minimizes short-term effects.

7.3.1.1.1 Overall Protection of Human Health and the Environment

This criterion serves as a final check in assessing whether each alternative provides adequate protection of human health and the environment. The analysis conducted for long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs is used to evaluate the overall protection of human health and the environment. This criterion is also used to evaluate how risks would be eliminated, reduced, or controlled through treatment, engineering, or institutional controls.

7.3.1.1.2 Compliance with ARARs

Compliance with ARARs is used to assess whether each alternative will attain the chemical-specific, location-specific, and action-specific ARARs identified in Table 4-1.

7.3.1.1.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence address the risk remaining at the Site after remediation goals have been met.

7.3.1.1.4 Reduction of Toxicity, Mobility, or Volume

Reduction of toxicity, mobility, or volume addresses the statutory preference for selecting removal actions that permanently and significantly reduce toxicity, mobility, and/or volume of hazardous materials at the Site. This preference is satisfied when treatment is used to reduce principal risks through destruction or irreversible reductions of toxicity, mobility, and/or volume.

7.3.1.1.5 Short-term Effectiveness

Short-term effectiveness addresses the effects of each alternative in the protection of human health and the environment during the construction and implementation phase. The following factors are addressed during the evaluation process:

- Protection of the workers during removal actions – This factor assesses threats that may be posed to workers and the effectiveness and reliability of measures to be taken.
- Environmental impacts of the removal action – This factor addresses the potential adverse environmental impacts that may result from construction and implementation of a removal alternative, and evaluates the reliability of mitigation measures, if necessary, to prevent or reduce potential impacts.
- Effects on local community – This factor addresses the potential adverse impacts on the local community, including psychological impacts and effects on the local economy, including tourism. Also includes the potential for accidents, increase in dust level, and threats to inadvertent intruders during removal activities.

7.3.2 Implementability

Implementability evaluates the technical feasibility of implementing each alternative, the availability of required services and materials during its implementation, and the administrative feasibility.

7.3.2.1.1 Technical Feasibility and Availability

Technical feasibility and availability address the ability to implement the alternative, the reliability of the alternative, and the availability of services and materials. USFS considers the

potential construction season to be from mid- to late-May to mid-October and depends on the snowpack present. The following factors were addressed during the evaluation process:

- Ability to construct and operate the technology;
- Reliability of the technology;
- Ease of undertaking additional removal actions, if necessary;
- Ability to monitor effectiveness of removal action; and
- Availability of necessary equipment, materials, and personnel.

7.3.2.1.2 Administrative Feasibility

The administrative feasibility criterion addresses the following factors:

- Likelihood of public acceptance of the alternative, including state and local governments concerns; and
- Activities needed to coordinate with other agencies

7.4 Cost

The cost of each alternative is evaluated based on estimates of capital cost for construction. Cost estimates are based on vendor information, cost-estimating guides, and actual costs incurred during studies performed at similar sites. Capital costs shown in Table 7-2 typically include the cost for construction activities, transportation, equipment, mobilization, and demobilization.

7.5 Comparative Analysis of Each Alternative

The comparative analysis of the removal action alternatives is summarized in Table 7-3. In addition, a quantitative ranking of the alternatives is presented in Table 7-2. The comparative analysis and discussion of each of the criteria in relation to the removal action alternatives is presented in the following sections.

7.5.1 Effectiveness

Alternative 1 – On-Site Repository with Impermeable Cap, In-situ Stabilization with Amendments, Revegetation

Rank on a scale of 0 to 6: High (6)

- Removal of the former mill soil, waste rock and debris for consolidation in an on-Site repository would protect ecological receptors, and reduces the potential for human exposure to the former mill soils; the physical hazard posed by the former mill slope and debris would be reduced;
- Removal of the tailings and/or contaminated soil from the AOCs downgradient of the former mill (MTA, UWA, and LWA) for consolidation in an on-site repository would protect

ecological receptors and reduce the potential for exposure to the AOCs downgradient of the former mill area; in addition, removal of the source area (former mill) in the vicinity of Trail Creek would provide long-term protectiveness of nearby surface water;

- COPCs exceeding "to be considered" criteria associated with BLM SVs and NPS ESVs would remain on Site; however, receptors exposure to the soil would be reduced by consolidation in the on-Site repository and covering wastes with the protective and vegetative layers;
- Covering the waste materials with an impermeable cap and vegetative layer would reduce the potential for contaminants to migrate to the subsurface for long-term protectiveness;
- This alternative would not reduce or eliminate toxicity or volume of waste, as the waste would remain on site in a constructed repository;
- This alternative would reduce but not eliminate wildlife exposure (mainly burrowing animals) to metals exposure in the consolidation area;
- The long-term effectiveness would depend on establishment of vegetation and limitation of human impact;
- The waste could be consolidated and covered in a single field season, providing immediate short-term effectiveness.
- In-situ stabilization using soil amendments in specific areas (e.g., lower washout areas) would reduce contaminant mobility, bioavailability, and toxicity of affected soil, and thereby reduce the exposure to human and ecological receptors

Alternative 2 – Off-Site Repository, In-situ Stabilization with Amendments, Revegetation
Rank on a scale of 0 to 6: High (6)

- Removal of the wastes to an off-site repository is protective of human health and the environment by removing the sources of contaminants from the Site and disposing the wastes elsewhere, such as a controlled facility or an off-site repository;
- COPCs exceeding "to be considered" criteria associated with BLM SVs and NPS ESVs would not be eliminated, however they would be placed in a facility that would limit exposure from human and ecological receptors;
- This alternative would eliminate exposure to burrowing animals on-site;
- No reduction in toxicity or volume through treatment, but high reduction in exposure through containment at a regulated repository;
- This alternative provides the most effective long-term effectiveness, as the wastes are removed from the Site and would be isolated from the environment in an off-site permitted waste facility;
- The waste could be removed in a single field season, providing immediate short-term effectiveness;
- Physical hazards to humans from the former mill site would be immediately addressed by re-grading and benching/stabilizing the slope grade and removing the former mill debris; and
- In-situ stabilization using soil amendments in specific areas (e.g., lower washout areas) would reduce contaminant mobility, bioavailability, and toxicity of affected soil, and thereby reduce the exposure to human and ecological receptors;

Alternative 3 – No Action
Rank on a scale of 0 to 6: High (6)

- This alternative is the least effective as it is not protective of human health and the environment, as the chemical and physical hazards would remain at the Site and with high exposure to receptors.

7.5.2 Implementability

Alternative 1 – On-Site Repository with Impermeable Cap, In-situ Stabilization with Amendments, Revegetation

Rank on a scale of 0 to 3: Moderate (2)

- Consolidation and covering the wastes from the former mill and downgradient AOCs is highly implementable;
- All materials required to implement consolidation and capping are available at the Site, except for liner materials, capillary barrier materials, soil amendments and seeding materials;
- Additional backfill required to reclaim excavated areas could be generated during construction of the on-site repository;
- The alternative is technically feasible using standard construction equipment and methods (excavators, dozers, loaders, haul trucks, backhoes); this equipment can feasibly access all areas, and be used to construct equipment access to the former mill; and
- Administrative feasibility is high as all consolidation and repository construction and reclamation would take place on USFS-managed lands; this alternative would likely be acceptable to the public on USFS-managed lands.

Alternative 2 – Off-Site Repository, In-situ Stabilization with Amendments, Revegetation

Rank on a scale of 0 to 3: Low (1)

- Removal of the wastes and transport to off-site repository is highly difficult to implement;
- It would be more affected by weather conditions, specifically for transport of wastes off-site through the Taylor Park access roads that can become muddy and subject to recreational traffic;
- Assumes the wastes could be disposed at the 6 Mile Lane Landfill, the nearest municipal solid waste facility located approximately 50 miles southeast of the Site in Gunnison County, Colorado;
- Although the wastes would be removed from the site, the post-removal and reclamation work required on-Site would equal that of Alternative 1, resulting in additional labor and expense compared to Alternative 1;

- The area evaluated as a potential on-site repository could alternatively be used as a source of backfill to restore excavated areas and positive drainage;
- A source of on-site backfill would be required to restore excavated areas for positive drainage, or importing of backfill may be required, which could be taken from the area identified for the onsite repository, and would require revegetation following excavation;
- The alternative is technically feasible using standard construction equipment and methods (excavators, dozers, loaders, haul trucks, and backhoes); and
- This alternative would likely be less acceptable to the public due to increased traffic from transportation trucks through the Taylor Park area and near rural neighborhoods on private and on USFS-managed lands and would require construction traffic control in the Taylor Park area.

Alternative 3 – No action

Rank on a scale of 0 to 3: High (3)

The no action alternative is the easiest to implement.

7.5.3 Estimated Cost

The relative costs of each alternative are evaluated based on professional experience, engineering judgment, and standard cost estimating tools referenced below. Primary cost considerations include capital costs and approximated engineering and design costs. The costs are estimated at the conceptual level, as defined by the American Association of Cost Engineers, and the *Cost Estimating Guide for Road Construction, USDA Forest Service Northern Region Engineering*, (USFS, 2017). The estimated costs are intended for alternative comparison only and are not for construction bid purposes. Per EPA guidance, engineering evaluation-level cost estimates are based on – 30% to + 50% range of accuracy.

A detailed breakdown of estimated costs for each Alternative is presented in Table 7-2 and is summarized below. Cost is ranked on a scale of Low (0) to 3 (High).

Alternative	Final Cost	Rank
Alternative 1, On-Site Repository with Impermeable Cap, In-situ Stabilization with Amendments, Revegetation	**$766,000**	**Moderate (2)**
Alternative 2, Off-Site Disposal, In-situ Stabilization with Amendments, Revegetation	**$1,385,000**	**Low (1)**
Alternative 3, No Action	**$0**	**High (3)**

Bold shows the highest-ranking Alternative

7.6 Final Ranking of Alternatives

A detailed breakdown of how each criterion rank for each Alternative is presented in Table 7-3 and is summarized below.

Alternative	Final Ranking
Alternative 1, On-Site Repository with Impermeable Cap, In-situ Stabilization with Amendments, Revegetation	**12**
Alternative 2, Off-Site Disposal, In-situ Stabilization with Amendments, Revegetation	10
Alternative 3, No Action - Does Not Meet ARARs/TBCs	9

12 – Bold shows the highest-ranking Alternative
9 – Underline shows the lowest ranking Alternative

8. RECOMMENDED REMOVAL ACTION ALTERNATIVE

Based on the elements of the alternatives and the comparative analysis and quantitative ranking in Section 7, the recommended alternative is consolidation of the wastes in an On-site Repository with an Impermeable Cap, and in-situ stabilization of thin surface tailings (Alternative 1). The recommended alternative would include excavation of the contaminated soil and debris from the former mill, as well as removal of the contaminated soil and/or tailings from the AOCs downgradient of the mill (including the MTA and UWA) for consolidation into a constructed on-site repository for covering with an impermeable cap, capillary barrier, and vegetative layer.

At LWA and in selected areas of the other AOCs, in-situ stabilization of thin tailings with amendments may be applied, including organic material, and pH buffers, such as calcium carbonate increasing the pH, stabilizing residual metals, and allowing revegetation. Identification of types and volumes of amendments would require additional testing during the removal design phase of the action. This would include backfilling, regrading and reclaiming these areas with necessary soil amendments to promote revegetation with species compatible with the area.

For the recommended Alternative 1, salvaged topsoil from the on-site repository footprint would be used to establish the vegetative cover over the on-Site repository. The top vegetative cover would be designed to tie-in to the grade of the surrounding undisturbed terrace deposit, to restore the area to resemble the original terrace deposit. The design for the repository surface will be graded or sloped appropriately to minimize infiltration of surface water into the underlying contaminated material and conform to the surrounding site topography. Rock-lined channels or other appropriate drainage controls could be designed and installed to divert surface runoff from the repository perimeter.

After excavation of the wastes, the steep slope of the former mill area would be regraded and benched to design grades for slope stabilization prior to reclaiming the area with organic soil amendments and revegetation with species compatible with the area. These actions would significantly reduce the physical hazards presently associated with the former mill area. After removal of the wastes to design depths at the AOCs downgradient of the former mill, these areas would be backfilled and regraded to promote positive drainage and reclaimed with organic soil amendments and revegetated with species compatible with the area.

The removal action would achieve the objectives of removal action to the extent practical by eliminating direct contact of surface-dwelling ecological receptors to the former mill and downgradient AOCs. There would still be a potential for burrowing organisms to come in contact with repository wastes. However, because of the consolidation of the wastes into one preferred location beneath compacted protective and vegetative layers, the potential for exposure is significantly reduced compared to the existing conditions.

Completion of the removal action would be enhanced with USFS institutional controls to prohibit recreational access to the reclaimed areas. Controls such as natural barriers (boulder placement and tree slash to protect near-term growth of vegetation) and signage could be installed along

the access road to the disturbed areas and the repository. These controls would be applied to restrict or control access to the former AOCs and repository to reduce the potential for human access and ATV access, and potentially enhance the reclamation/restoration by limiting visitor access.

The recommended alternative will satisfy the eight factors in 40 CFR 300.415(b) as described in Table 8-1.

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TABLES

Table 2-1: Groundwater Wells in Site Vicinity

Applicant Name	Permit	Latitude	Longitude	Use	Elevation (ft amsl)	Total Depth (ft bgs)	Top of Perforations (ft bgs)	Bottom of Perforations (ft bgs)	Yield (gpm)	Static Water Level (ft bgs)
KURZ, ROY	1276-	38.931576	-106.59427	Domestic	-	-	-	-	-	-
GREEN, DEWAYNE E	144870-	38.932077	-106.590669	Household use only	-	95	86	95	7	80
KIMSEY, RALPH	145363-	38.932544	-106.589685	Household use only	-	83	74	83	-	57
OWENS, BLANCHE F	145485-	38.930208	-106.589616	Household use only	-	110	101	110	-	87
KURZ, ROY R	1276--A	38.929976	-106.58916	Domestic	-	90	81	90	15	65
WILLIAMS, RAYMOND H	11362-TH	38.915074	-106.587224	Monitoring/Sampling	-	-	-	-	-	-
TAYLOR PARK POOL ASSOCIATIO	34179-	38.891216	-106.570681	Domestic	-	-	-	-	-	-
ANDRIULLI, JOHN	294399-	38.898719	-106.553219	Domestic	9666	90	50	90	4015	40
BELLES & BULLETS LLC	306661-	38.895856	-106.542651	Domestic	9751	193	-	-		61
SCHMILLEN LORA AND JEFF	285254-	38.894297	-106.531882	Domestic	-	150	110	150	15	52
BELLES & BULLETS LLC	268880-	38.894653	-106.542491	Domestic	-	103	83	103	12	40
MACKINTOSH, ROBERT	159588-	38.891247	-106.542707	Domestic	9600	120	91	120	-	30
STUMP, R C	267251-	38.887497	-106.532321	Domestic	-	220	140	200	20	100
L & M SNYDER LLC	128777-	38.888319	-106.547427	Domestic	-	34	19	28	-	16
ALBRIGHT FAMILY TRUST	187244-	38.885233	-106.546034	Domestic	10000	155	100	140	5	30

ft amsl - Feet above mean sea level
ft bgs - Feet below ground surface
gpm - Gallons per minute

Table 2-2: 2010 Soil Sampling Data

Analyte	CAS Number	Background Soil FH-BKG SED			Sediment FH-SED-1				Sediment FH-SED-2				Tailings FH-TL-FHD			
		Result (mg/kg)	Flag	MDL (mg/kg)	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis																
Antimony	7440-36-0	ND	U	0.2	ND	U	2	X*	5.1		0.2	X	201		4	X
Arsenic	7440-38-2	2.9		0.3	ND	U	3	X**	8.5		0.3	X	147		5	X
Cadmium (Diet) (A)	7440-43-9	0.25	B	0.05	ND	U	0.5	X**	18.1		0.05	X	63		1	X
Chromium, Total	7440-47-3	11		1	1	B	1		18		1	X	ND	U	1	
Copper	7440-50-8	9		1	193		1	X	58		1	X	292		1	X
Iron	7439-89-6	14500		2	8510		2		21200		2	X	10700		2	
Lead	7439-92-1	16	B	4	7350		4	X	571		4	X	18500		4	X
Manganese	7439-96-5	479		0.5	54.5		0.5		684		0.5	X	52.7		0.5	
Mercury	7439-97-6	ND	U	0.04	2.02		0.04	X	0.12	B	0.04	X	1.78		0.04	X
Nickel	7440-02-0	6		1	1	B	1		9		1	X	ND	U	1	
Selenium	7782-49-2	0.28		0.05	ND	U	0.5	X**	0.47		0.05	X	4		1	X
Silver	7440-22-4	0.07	B	0.03	ND	U	0.3	X**	4.23		0.03	X	159		0.5	X
Zinc	7440-66-6	72		1	4190		1	X	1180		1	X	8170		1	X
Zinc	7440-66-6	72		1	4190		1	X	1180		1	X	8170		1	X

Analyte	CAS Number	Background Soil FH-BKG SED			Tailings FH-TL-1				Tailings FH-TL-2			
		Result (mg/kg)	Flag	MDL (mg/kg)	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis												
Antimony	7440-36-0	ND	U	0.2	216		4.0	X	1.8		0.2	X
Arsenic	7440-38-2	2.9		0.3	135		5.0	X	11.5		0.3	X
Cadmium (Diet) (A)	7440-43-9	0.25	B	0.05	63		1.0	X	13.1		0.05	X
Chromium, Total	7440-47-3	11		1	ND	U	1.0		14		1	X
Copper	7440-50-8	9		1	243		1.0	X	103		1	X
Iron	7439-89-6	14500		2	9550		2.0		23200		2	X
Lead	7439-92-1	16	B	4	14200		4.0	X	542		4	X
Manganese	7439-96-5	479		0.5	53.8		0.5		248		0.5	
Mercury	7439-97-6	ND	U	0.04	2.2		0.04	X	ND	U	0.04	
Nickel	7440-02-0	6		1	ND	U	1.0		7		1	X
Selenium	7782-49-2	0.28		0.05	3		1.0	X	0.33		0.05	X
Silver	7440-22-4	0.07	B	0.03	134		0.5	X	2.35		0.03	X
Zinc	7440-66-6	72		1	8080		1.0	X	885		1	X

Notes:

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.

Acronyms

MDL - Laboratory Method Detection Limit
mg/kg - Milligrams per kilogram
ND - Not detected at or above MDL

Lab Data Flags:

B - Result is an estimated value.
J - The identification of the analyte is acceptable; the reported value is an estimate.
J3 - The associated batch QC was outside the established quality control range for precision.
J6 - The sample matrix interfered with the ability to make any accurate determination; spike value is low.
O1 - The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference
U - Analyte was not detected above the MDL.
V - The sample concentration is too high to evaluate accurate spike recoveries.

Analysis Data Flags:

(A) - Data analysis required use of specific chemical name for lookup
X* - Analyte not detected. Sample MDL exceeds detected background MDL.
X** - Analyte not detected. Sample MDL exceeds detected background concentration.

Table 2-3: 2010 Water Sampling Data

Analyte	CAS Number	FH-BKG-SW			FH-DNS-SW				FH-TRAIL CK				FH-TAYLOR R				FH-SW-1			
		Result (mg/L)	Flag	MDL (mg/L)	Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance	Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance	Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance	Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance
Metals Analysis																				
Antimony	7440-36-0	ND	U	0.0004	ND	U	0.0004		ND	U	0.0004		ND	U	0.0004		ND	U	0.0004	
Arsenic	7440-38-2	ND	U	0.0005	ND	U	0.0005		0.0005	B	0.0005		ND	U	0.0005		ND	U	0.0005	
Cadmium (Water) (A)	7440-43-9	ND	U	0.0001	ND	U	0.0001		ND	U	0.0001		ND	U	0.0001		ND	U	0.0001	
Calcium	7440-70-2	6.2		0.2	6.3		0.2	X	6.3		0.2	X	19.7		0.2	X	17.3		0.2	X
Chromium	7440-47-3	ND	U	0.01	ND	U	0.01		ND	U	0.01		ND	U	0.01		ND	U	0.01	
Copper	7440-50-8	ND	U	0.01	ND	U	0.01		ND	U	0.01		ND	U	0.01		ND	U	0.01	
Iron	7439-89-6	0.32		0.02	0.24		0.02		0.22		0.02		0.11		0.02		0.09		0.02	
Lead	7439-92-1	0.0001	B	0.0001	0.0002	B	0.0001	X	0.0001	B	0.0001		ND	U	0.0001		ND	U	0.0001	
Magnesium	7439-95-4	1.3		0.2	1.4		0.2	X	1.4		0.2	X	5.3		0.2	X	5		0.2	X
Manganese	7439-96-5	0.02	B	0.005	0.007	B	0.005		0.006	B	0.005		0.028	B	0.005	X	0.027	B	0.005	X
Mercury	7439-97-6	ND	U	0.0002	ND	U	0.0002		ND	U	0.0002		ND	U	0.0002		ND	U	0.0002	
Nickel	7440-02-0	ND	U	0.01	ND	U	0.01		ND	U	0.01		ND	U	0.01		ND	U	0.01	
Potassium	7440-09-7	0.6	B	0.3	0.6	B	0.3		0.6	B	0.3		0.6	B	0.3		0.8	B	0.3	X
Selenium	7782-49-2	ND	U	0.0001	ND	U	0.0001		ND	U	0.0001		ND	U	0.0001		ND	U	0.0001	
Silver	7440-22-4	ND	U	0.00005	ND	U	0.00005		ND	U	0.00005		ND	U	0.00005		ND	U	0.00005	
Sodium	7440-23-5	3.8		0.3	3.9		0.3	X	4.1		0.3	X	2.6		0.3		4.2		0.3	X
Zinc	7440-66-6	ND	U	0.01	ND	U	0.01		ND	U	0.01		ND	U	0.01		ND	U	0.01	
Wet Chemistry																				
Acidity as CaCO3		ND	U	10	ND	U	10		ND	U	10		ND	U	10		ND	U	10	
Bicarbonate as CaCO3	10139	28		2	28		2		28		2		57		2	X	66		2	X
Boron	7440-42-8	ND	U	0.01	ND	U	0.01		ND	U	0.01		ND	U	0.01		ND	U	0.01	
Carbonate as CaCO3		ND	U	2	ND	U	2		ND	U	2		ND	U	2		ND	U	2	
Chloride	16887-00-6	ND	U	1	ND	U	1		ND	U	1		ND	U	1		ND	U	1	
Cyanide	57-12-5	ND	U	0.003	ND	U	0.003		ND	U	0.003		ND	U	0.003		ND	U	0.003	
Hardness as CaCO3		21		1	22		1	X	22		1	X	71		1	X	64		1	X
Hydroxide as CaCO3		ND	U	2	ND	U	2		ND	U	2		ND	U	2		ND	U	2	
Nitrate as N, dissolved	14797-55-8	ND	U	0.02	ND	U	0.02		ND	U	0.02		ND	U	0.02		ND	U	0.02	
Nitrate/Nitrite as N, dissolved		ND	HU	0.02	ND	HU	0.02		ND	HU	0.02		ND	HU	0.02		ND	HU	0.02	
Nitrite as N	14797-65-0	ND	HU	0.01	ND	HU	0.01		ND	HU	0.01		ND	HU	0.01		ND	HU	0.01	
Nitrogen, ammonia	7664-41-7	ND	U	0.05	ND	U	0.05		ND	U	0.05		ND	U	0.05		ND	U	0.05	
Residue, Filterable (TDS) @180C		40		10	40		10		40		10		80		10	X	80		10	X
Residue, Non-Filterable (TSS) @105C		ND	U	5	ND	U	5		ND	U	5		ND	U	5		71		5	
Sulfate	14808-79-8	ND	U	1	ND	U	1		ND	U	1		17		1		ND	U	1	
Sulfide as S	18496-25-8	ND	U	0.02	ND	U	0.02		ND	U	0.02		ND	U	0.02		ND	U	0.02	
TDS (calculated)		29	B	10	29	B	10		29	B	10		80		10	X	67		10	X
Total Alkalinity	10093	28		2	28		2		28		2		57		2	X	66		2	X

Notes:

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.

Acronyms

MDL - Laboratory Method Detection Limit

mg/kg - Milligrams per kilogram
mg/L – milligrams per liter
ND - Not detected at or above MDL

Lab Data Flags:

B - Result is an estimated value.
H - Analysis exceeded method hold time
J - The identification of the analyte is acceptable; the reported value is an estimate.
J3 - The associated batch QC was outside the established quality control range for precision.
J6 - The sample matrix interfered with the ability to make any accurate determination; spike value is low.
O1 - The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference
U - Analyte was not detected above the MDL.
V - The sample concentration is too high to evaluate accurate spike recoveries.

Analysis Data Flags:

(A) - Data analysis required use of specific chemical name for lookup

Table 2-4: 2010 Synthetic Precipitation Leach Procedure Sampling Data

Analyte	CAS Number	SPLP Screening Levels [1]	Tailings SPLP FH-TL-FHD				Tailings SPLP FH-TL-1				Tailings SPLP FH-TL-2			
			Result (mg/L)	Flag	MDL (mg/L)	Risk Ratio Result/SL	Result (mg/L)	Flag	MDL (mg/L)	Risk Ratio Result/SL	Result (mg/L)	Flag	MDL (mg/L)	Risk Ratio Result/SL
Metals Analysis														
Antimony	7440-36-0	0.156	0.045		0.002	0.3	0.053		0.002	0.3	ND	U	0.0004	0.0
Arsenic	7440-38-2	0.00104	0.0029		0.0005	**2.8**	0.0019	B	0.0005	**1.8**	ND	U	0.0005	0.5
Cadmium	7440-43-9	0.184	0.2271		0.0005	**1.2**	0.1879		0.0001	1.0	0.0683		0.0001	0.4
Chromium	7440-47-3	440	ND	U	0.01	0.0	ND	U	0.01	0.0	ND	U	0.01	0.0
Copper	7440-50-8	16	0.1		0.01	0.0	0.09		0.01	0.0	0.04	B	0.01	0.0
Iron	7439-89-6	280	0.07		0.02	0.0	0.04	B	0.02	0.0	0.1		0.02	0.0
Lead	7439-92-1	0.3	7.91		0.04	**26.4**	8.94		0.04	**29.8**	ND	U	0.04	0.1
Manganese	7439-96-5	8.6	0.112		0.005	0.0	0.149		0.005	0.0	0.066		0.005	0.0
Mercury	7439-97-6	0.0126	ND	U	0.0002	0.0	ND	U	0.0002	0.2	ND	U	0.0002	0.0
Nickel	7440-02-0	7.8	ND	U	0.01	0.0	ND	U	0.01	0.0	0.01	B	0.01	0.0
Selenium	7782-49-2	2	0.0002	B	0.0001	0.0	0.0001	B	0.0001	0.0	ND	U	0.0001	0.0
Silver	7440-22-4	1.88	0.00307		0.00005	0.0	0.00217		0.00005	0.0	0.00019	B	0.00005	0.0
Zinc	7440-66-6	1.72	21.1		0.01	**12.3**	17.4		0.01	**10.1**	5.56		0.01	**3**

Notes:

[1] SPLP Screening Levels - USEPA Regional Screening Levels for Residential Tap water multiplied by a dilution attenuation factor of 20
CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.
MDL - Laboratory Method Detection Limit
mg/L - Milligrams per liter
ND - Not detected at or above MDL
Risk Ratio - SPLP result/SPLP Screening Level
SL – Screening Level
SPLP -Synthetic Precipitation Leach Procedure

Lab Data Flags:

B - Result is an estimated value.
U - Analyte was not detected above the MDL.

Table 3-1: Sampling and Field Data Summary

Location and Media	Sample ID	Chemical Analyses	Supporting Data	QA/QC Samples	Laboratory Analyses
Former Mill Upper (FMU); Composite of 6 soil samples	FHM-FMU-SS-001	Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc, Acid-Base Accounting (ABA) and Nutrients [1]	N/A	Collected extra volume for laboratory MS/MSD [2] (metals only)	6010B 7471A
Former Mill Lower (FML); Composite of 7 soil samples	FHM-FML-SS-001	Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc, ABA and Nutrients	N/A	N/A	6010B 7471A
Main Tailings Area 1 (MTA1); Composite of 7 soil samples	FHM-MTA1-SS-001	ABA and Nutrients only (metals data established by previous investigation)	Excavated test pits at nine locations; noted lithology and thickness of surface tailings	N/A	6010B 7471A
Main Tailings Area 2 (MTA2); Composite of 6 soil samples	FHM-MTA2-SS-001	Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc, ABA and Nutrients	Excavated test pits at six locations; noted lithology and thickness of surface tailings	Collected extra volume for duplicate sample FHM-UA-SS-001	6010B 7471A
Upper Washout Area 1 (UWA1); Composite of 6 soil samples	FHM-UWA1-SS-001	Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc, ABA and Nutrients	Determined thickness of surface tailings with hand-spade at six sampling locations	N/A	6010B 7471A

Location and Media	Sample ID	Chemical Analyses	Supporting Data	QA/QC Samples	Laboratory Analyses
Upper Washout Area 2 (UWA2); Composite of 6 soil samples	FHM-UWA2-SS-001	Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, and Zinc	N/A	N/A	6010B 7471A
Lower Washout Area 1 (LWA1); Composite of 6 soil samples	FHM-LWA1-SS-001	Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Silver, Zinc, ABA and Nutrients	N/A	N/A	6010B 7471A
Lower Washout Area 2 (LWA2); Composite of 6 soil samples	FHM-LWA2-SS-001	Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Silver, Zinc, ABA and Nutrients	N/A	N/A	6010B 7471A
Surface Water upstream of Former Mill and co-located sediment sample	FHM-TC-SW-001 (Water) FHM-TC-SD-001 (Sediment)	Water: Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc and Hardness. Sediment: (same metals as above for soil)	Measure stream flow and water quality field parameters [3]	Collect one matrix spike/matrix spike duplicate sample (MS/MSD) for sediment	Water: 130.1 200.7 245.1 Sediment: 6010B 7471A

Location and Media	Sample ID	Chemical Analyses	Supporting Data	QA/QC Samples	Laboratory Analyses
Surface Water immediately downstream of Former Mill and co-located sediment sample	FHM-TC-SW-002 (Water) FHM-TC-SD-002 (Sediment)	Water: Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc and Hardness. Sediment: (same metals as above for soil)	Measure stream flow and field parameters	Collected duplicate water sample FHM-TC-SW-004 Collected duplicate sediment sample FHM-TC-SD-004	Water: 130.1 200.7 245.1 Sediment: 6010B 7471A
Surface Water Downgradient in Trail Creek and co-located sediment sample	FHM-TC-SW-003 (Water) FHM-TC-SD-003 (Sediment)	Water: Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc and Hardness. Sediment: (same metals as above for soil)	Measure stream flow and field parameters	Collected extra volume of water sample for MS/MSD	Water: 130.1 200.7 245.1 Sediment: 6010B 7471A
Potential Repository (East)	FHM-REP-SS-001	Soil nutrients only (topsoil)	Test pit to approximately 6-feet	N/A	N/A
Potential Repository (West)	N/A	N/A	Test pit to approximately 6-feet	N/A	N/A

[1] Soil nutrient analyses included paste pH, electrical conductivity, lime estimate, percent organic matter, nitrate-nitrite, phosphorous, potassium, zinc, iron, manganese, and copper.
[2] MS/MSD = Laboratory matrix spike/matrix spike duplicate sample
[3] Water quality field parameters include: temperature, dissolved oxygen, specific conductance, pH, oxidation reduction potential [ORP], and turbidity.

Table 3-2: Forest Hill Test Pit Summary Log

Sample Location	Pit Excavated?	Tailings Depth	REMARKS
Former Mill (Upper)			
FMU-001	No	1 to 2 feet (est.)	Too steep and no access to excavating equipment
FMU-002	No	1 to 2 feet (est.)	Too steep and no access to excavating equipment
FMU-003	No	1 to 2 feet (est.)	Too steep and no access to excavating equipment
FMU-004	No	1 to 2 feet (est.)	Too steep and no access to excavating equipment
FMU-005	No	1 to 2 feet (est.)	Too steep and no access to excavating equipment
FMU-006	No	1 to 2 feet (est.)	Too steep and no access to excavating equipment
Former Mill (Lower)			
FML-001	No	1 to 4 feet (est.)	No access to excavating equipment
FML-002	No	1 to 4 feet (est.)	No access to excavating equipment
FML-003	No	1 to 4 feet (est.)	No access to excavating equipment
FML-004	No	1 to 4 feet (est.)	No access to excavating equipment
FML-005	No	1 to 4 feet (est.)	No access to excavating equipment
FML-006	No	1 to 4 feet (est.)	No access to excavating equipment
MTA1 Area, Tailings depth determined with mini-excavator at all locations			
MTA1-001	Yes	0"	
MTA1-002	Yes	8"	
MTA1-003	Yes	8"	
MTA1-004	Yes	< 6"	
MTA1-005	Yes	< 6"	
MTA1-006	Yes	6"	
MTA1-007	Yes	6"	
MTA1-008	Yes	12"	Additional pit excavated 75 feet east of Pit 003
MTA1-009	Yes	2"	Additional pit excavated central MTA1 40 feet south of road
MTA2 Area, Tailings depth determined with hand spade at all locations			
MTA2-001	No	2"	
MTA2-002	No	0"	
MTA3-003	No	1"	
MTA2-004	No	0"	
MTA2-005	No	1-2"	
MTA2-006	No	0"	
UWA 001, Tailings depth determined with hand-spade at all locations			
UWA1-001	No	0"	
UWA1-002	No	3"	Skim sample
UWA1-003	No	2-3"	Skim sample
UWA1-004	No	2-3"	Skim sample
UWA1-005	No	2-3"	Skim sample
UWA1-006	No	5"	Skim sample
UWA 002, Tailings depth determined with hand-spade at all locations			
UWA2-001	No	0"	
UWA2-002	No	0"	
UWA2-003	No	0"	
UWA2-004	No	0"	
UWA2-005	No	0"	
UWA2-006	No	0"	
LWA1 Area	No	0"	No visible tailings at all sampling locations
LWA2 Area	No	0"	No visible tailings at all sampling locations

Table 3-3: Acid Generation Potential of Former Forest Hill Mill and Tailings Areas

Sample ID	Paste pH	AGP	ANP	ABP	Ratio ANP/AGP	US BLM Guidance Level ANP/AGP	Remarks
FHM-FMU-SS-001	5.1	4.69	3.0	-1.7	**0.64**	> 3	Former Mill Upper
FHM-FML-SS-001	4.3	92.20	0.0	-92.20	**0.00**	> 3	Former Mill Lower
FHM-MTA1-SS-001	4.6	8.13	0.0	-8.10	**0.00**	> 3	Main Tailings Area 1
FHM-MTA2-SS-001	5.2	5.63	2.0	-3.60	**0.36**	> 3	Main Tailings Area 2
FHM-UWA1-SS-001	4.8	11.30	0.0	-11.3	**0.0**	> 3	Upper Washout Area 1
FHM-LWA1-SS-001	5.2	2.50	3.0	0.5	**1.2**	> 3	Lower Washout Area 1
FHM-LWA2-SS-001	5.5	1.56	3.0	1.4	**1.9**	> 3	Lower Washout Area 2

Notes:
AGP – acid generation potential
ANP – acid neutralization potential
ABP – acid-base potential
Results for AGP, ANP, and ABP reported in tons of calcium carbonate per kiloton (tons CaCO3/Kt)
Results in **bold type** indicate potentially acid-generating (exceedance) of United States Bureau of Land Management (BLM) criterion of ANP:AGP ratio of > 3

Table 3-4: Summary of Sobek Sulfide-Sulfate Results

Sample ID	Percent Sulfide-Sulfur (Total Sulfur minus Sulfate Sulfur)	Percent Sulfide-Sulfur - Sobek Method Upper Boundary
FHM-FMU-SS-001	0.12%	>9%
FHM-FML-SS-001	2.2%	>9%
FHM-MTA1-SS-001	0.15%	>9%
FHM-MTA2-SS-001	0.12%	>9%
FHM-UWA1-SS-001	0.24%	>9%
FHM-LWA1-SS-001	0.05%	>9%
FHM-LWA2-SS-001	0.03%	>9%

Notes:
The Sobek Method (USGS, 2003) indicates an upper boundary of 9% or greater sulfide-sulfur would indicate that the material is acid-generating and all other waste material would require 100% calcium carbonate to neutralize the materials.

Table 3-5: Summary of Sulfide/Sulfur, Paste pH, and Neutralization Potential Ratio Results

Sample ID	Percent Sulfide-Sulfur (Total Sulfur minus Sulfate Sulfur)	pH	Price, et. al Guidance 1997
FHM-FMU-SS-001	0.12%	5.1	Between non acid-generating and likely acid-generating
FHM-FML-SS-001	2.2%	4.3	Likely acid-generating
FHM-MTA1-SS-001	0.15%	4.6	Between non acid-generating and likely acid-generating
FHM-MTA2-SS-001	0.12%	5.2	Between non acid-generating and likely acid-generating
FHM-UWA1-SS-001	0.24%	4.8	Between non acid-generating and likely acid-generating
FHM-LWA1-SS-001	0.05%	5.2	Between non acid-generating and likely acid-generating
FHM-LWA2-SS-001	0.03%	5.5	No potential for acid-generation

Notes:

The Price, et. al. guidance indicates that Sulfide-Sulfur <0.3% and pH >5.5 indicates "no potential for acid generation"; and Sulfide -Sulfur >0.3% and pH <5.5 indicates "likely acid-generating."

Table 3-6: Soil Nutrients

SAMPLE ID	AREA	Paste pH	Paste EC mmhos/cm	Lime Estimate	% Organic Matter	Milligrams per Liter (mg/L) Nitrate-nitrite	Phosphorus	Potassium	Zinc	Iron	Manganese	Copper	Soil type
FHM-FMU-SS-001	Former Mill (upper)	4.9	0.6	low	4.0	3.4	28.5	58.5	300	180	8.5	38.9	sandy loam
FHM-FML-SS-001	Former Mill (lower)	3.4	1.6	low	3.4	0.8	7.3	19.0	278	52.0	4.1	11.8	sandy loam
FHM-MTA1-SS-001	MTA1	4.2	0.9	low	4.7	4.6	21.5	64.6	414	131	3.9	40.1	sandy loam
FHM-MTA2-SS-001	MTA2	4.8	0.3	low	7.7	12.7	21.4	77.1	411	104	4.5	26.4	sandy loam
FHM-LWA1-33-001	Lower Washout Area 1	4.7	0.3	low	6.6	6.4	19.1	149	340	53.7	18.9	41.4	loam
FHM-LWA2-SS-001	Lower Washout Area 2	4.8	0.3	low	6.3	6.8	16.9	125	410	21.1	6.0	18.6	loam
FHM-UWA-SS-001	Upper Washout	4.5	0.5	low	5.8	10.6	22.1	50.4	382	133	2.4	35.2	sandy loam
FHM-REP-SS-001	Potential Repository	6.0	0.2	low	7.9	4.1	14.6	300	8.4	58.9	6.2	0.8	loam

Notes:

EC – Electrical conductance in millimhos per centimeter (mmhos/cm)
mg/L – milligrams per liter
pH – Standard unit (s.u.); pH is measured on a logarithmic scale, ranging from 0 to 14 s.u., with 7 s.u. being neutral pH.
% – percent

Table 3-7: Forest Hill Mill Water Quality Measurements, October 2018

Sample Location	Latitude	Longitude	Temp (° C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	pH	ORP (mV)	Turbidity (NTU)
FHM-TC-SW-001	38°55'13.22"N	106°36'46.16"W	3.7	9.17	57.8	6.7	275.7	1.72
FHM-TC-SW-002	38°55'15.56"N (A)	106°36'42.71"W (A)	3.6	9.49	57.9	7.49	251.2	1.52
FHM-TC-SW-003	38°55'15.84"N	106°36'22.72"W	3.4	9.64	79.6	8.09	221.9	1.43

Latitude and Longitude collected using handheld GPS unit.
(A) – Location/Coordinates of sample corrected in Google Earth based on aerial photography
°C – Degrees Centigrade
µS/cm – MicroSiemens per centimeter
mg/L – Milligrams per liter
mV – Millivolts
NTU – Nephelometric Turbidity Unit

Table 3-8: 2018 Soil Sampling Results

Analyte	CAS Number	Background Soil FH-BKG SED			2018 Soil FHM-FMU-SS-001				2018 Soil FHM-FML-SS-001				Tailings FH-TL-1			
		Result (mg/kg)	Flag	MDL (mg/kg)	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis																
Antimony	7440-36-0	ND	U	0.2	5.96	J3 J6	0.75	X	113		0.75	X	216		4.0	X
Arsenic	7440-38-2	2.9		0.3	10		0.46	X	64.6		0.46	X	135		5.0	X
Cadmium	7440-43-9	0.25	B	0.05	20.2	J3	0.07	X	263		0.07	X	63		1.0	X
Chromium, Total	7440-47-3	11		1	7.99		0.14		2.47		0.14		ND	U	1.0	
Copper	7440-50-8	9		1	83.4	O1	0.53	X	290		0.53	X	243		1.0	X
Iron	7439-89-6	14500		2	15600	J3 O1 V	1.41	X	13700		1.41		9550		2.0	
Lead	7439-92-1	16	B	4	932	V	0.19	X	8350		0.19	X	14200		4.0	X
Manganese	7439-96-5	479		0.5	234	J6 O1	0.12		207		0.12		53.8		0.5	
Mercury	7439-97-6	ND	U	0.04	0.0992	J6	0.0028	X	6.44		0.028	X	2.2		0.04	X
Nickel	7440-02-0	6		1	5.06		0.49		1.21	J	0.49		ND	U	1.0	
Selenium	7782-49-2	0.28		0.05	ND	U	0.62	X**	1.37	J	0.62	X	3		1.0	X
Silver	7440-22-4	0.07	B	0.03	6.32		0.12	X	94.2		0.12	X	134		0.5	X
Zinc	7440-66-6	72		1	1360	J3 O1 V	0.59	X	29800		11.8	X	8080		1.0	X

Analyte	CAS Number	2018 Soil FHM-MTA-2-SS-001				2018 Soil FHM-UA-SS-001				2018 Soil FHM-UWA1-SS-001				2018 Soil FHM-UWA2-SS-001			
		Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis																	
Antimony	7440-36-0	26.6		0.75	X	27		0.75	X	72.8		1.17	X	7.51		0.75	X
Arsenic	7440-38-2	26.6		0.46	X	24.9		0.46	X	60.9		0.719	X	8.68		0.46	X
Cadmium	7440-43-9	30.1		0.07	X	32.1		0.07	X	40.1		0.109	X	42.4		0.07	X
Chromium, Total	7440-47-3	10.5		0.14		9.12		0.14		6.25		0.219		11.7		0.14	X
Copper	7440-50-8	161		0.53	X	167		0.53	X	258		0.828	X	90.9		0.53	X
Iron	7439-89-6	17500		1.41	X	15600		1.41	X	13800		2.2		18500		1.41	X
Lead	7439-92-1	3110		0.19	X	2990		0.19	X	4910		0.297	X	933		0.19	X
Manganese	7439-96-5	264		0.12		287		0.12		123		0.188		493		0.12	X
Mercury	7439-97-6	0.332		0.0028	X	0.401		0.0028	X	1.35		0.0056	X	0.0875		0.0028	X
Nickel	7440-02-0	5.64		0.49		5.18		0.49		2.69	J	0.766		7.74		0.49	X
Selenium	7782-49-2	ND	U	0.62	X**	ND	U	0.62	X**	ND	U	0.969	X**	ND	U	0.62	X**
Silver	7440-22-4	31.4		0.12	X	29.6		0.12	X	57.1		0.188	X	7.41		0.12	X
Zinc	7440-66-6	1960		2.95	X	2000		2.95	X	3300		4.61	X	2140		2.95	X

Analyte	CAS Number	2018 Soil FHM-LW1-SS-001				2018 Soil FHM-LWA2-SS-001			
		Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis									
Antimony	7440-36-0	4.75		0.75	X	5		0.75	X
Arsenic	7440-38-2	6.47		0.46	X	6.99		0.46	X
Cadmium	7440-43-9	19.2		0.07	X	23		0.07	X
Chromium, Total	7440-47-3	14.6		0.14	X	14.5		0.14	X
Copper	7440-50-8	70.3		0.53	X	64.4		0.53	X
Iron	7439-89-6	17500		1.41	X	21000		1.41	X
Lead	7439-92-1	496		0.19	X	557		0.19	X
Manganese	7439-96-5	602		0.12	X	494		0.12	X
Mercury	7439-97-6	0.0641		0.0028	X	0.0594		0.0028	X
Nickel	7440-02-0	8.99		0.49	X	10.4		0.49	X
Selenium	7782-49-2	ND	U	0.62	X**	0.817	J	0.62	X
Silver	7440-22-4	3.28		0.12	X	4.83		0.12	X
Zinc	7440-66-6	687		0.59	X	1210		0.59	X

Notes:

FH-BKG SED is used as the background comparison point for the exceedance analysis
FH-TL-1 is included as a surrogate for a soil sample at FHM-MTA-1-SS-01
FHM-UA-SS-001 is a duplicate of FHM-MTA-2-SS-01

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.

Acronyms

MDL - Laboratory Method Detection Limit
mg/kg - Milligrams per kilogram
ND - Not detected at or above MDL

Lab Data Flags:

B - Result is an estimated value.
J - The identification of the analyte is acceptable; the reported value is an estimate.
J3 - The associated batch QC was outside the established quality control range for precision.
J6 - The sample matrix interfered with the ability to make any accurate determination; spike value is low.
O1 - The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference
U - Analyte was not detected above the MDL.
V - The sample concentration is too high to evaluate accurate spike recoveries.

Analysis Data Flags:

(A) - Data analysis required use of specific chemical name for lookup

ND = Analyte not detected
X = Background established value from 2010 sampling event is exceeded.
X** - Analyte not detected. Sample MDL exceeds detected background concentration.

Table 3-9: Summary Statistics for Metals in Soils, October 2018

Analyte	CAS Number	Minimun (mg/kg)	Maximum (mg/kg)	Mean (mg/kg)	Standard Deviation (mg/kg)	Background (mg/kg)
Antimony	7440-36-0	4.75	216	53.2	67.4	ND
Arsenic	7440-38-2	6.47	135	38.2	40.2	2.9
Cadmium	7440-43-9	19.2	263	59.2	73.2	0.25
Chromium, Total	7440-47-3	2.47	14.6	9.6	3.9	11
Copper	7440-50-8	64.4	290	159	82.5	9
Iron	7439-89-6	9550	21000	15861	3120	14500
Lead	7439-92-1	496	14200	4053	4327	16
Manganese	7439-96-5	53.8	602	306	174	479
Mercury	7439-97-6	0.0594	6.44	1.2	2.0	ND
Nickel	7440-02-0	1.21	10.4	5.9	2.9	6
Selenium	7782-49-2	0.817	3.0	1.7	0.9	0.28
Silver	7440-22-4	3.28	134	40.9	43.5	0.07
Zinc	7440-66-6	687	29800	5615	8798	72

Background – Based on results from soil sample collected at sampling location FH-BKG-SED in September of 2010.
CAS – Chemical Abstract Services number.
mg/kg – Milligrams per kilogram.

Table 3-10: 2018 Sediment Sampling Results

Analyte	CAS Number	2018 Upgradient Sediment FHM-TC-SD-001			2018 Sediment FHM-TC-SD-002				2018 Sediment FHM-TC-SD-003				2018 Sediment FHM-TC-SD-004			
		Result (mg/kg)	Flag	MDL (mg/kg)	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis																
Antimony	7440-36-0	ND	U	0.75	ND	U	0.75		ND	U	0.75		ND	U	0.75	
Arsenic	7440-38-2	ND	U	0.46	ND	U	0.46		ND	U	0.46		ND	U	0.46	
Cadmium	7440-43-9	0.118	J	0.07	2.57		0.07	X	0.183	J	0.07	X	3.91		0.07	X
Chromium, Total	7440-47-3	3.41		0.14	3.84		0.14	X	2.37		0.14		4.9		0.14	X
Copper	7440-50-8	0.761	J	0.53	1.49	J	0.53	X	1.18	J	0.53	X	1.98	J	0.53	X
Iron	7439-89-6	3720	J5	1.41	6380		1.41	X	4720		1.41	X	7010		1.41	X
Lead	7439-92-1	1.42		0.19	9.57		0.19	X	14.8		0.19	X	7.11		0.19	X
Manganese	7439-96-5	213	J5	0.12	237		0.12	X	173		0.12		197		0.12	
Mercury	7439-97-6	ND	U	0.0028	ND	U	0.0028		ND	U	0.0028		ND	U	0.0028	
Nickel	7440-02-0	2.11		0.49	2.07		0.49		1.48	J	0.49		2.54		0.49	X
Selenium	7782-49-2	ND	U	0.62	ND	U	0.62		ND	U	0.62		ND	U	0.62	
Silver	7440-22-4	ND	U	0.12	ND	U	0.12		ND	U	0.12		ND	U	0.12	
Zinc	7440-66-6	16.2		0.59	105		0.59	X	31.1		0.59	X	161		0.59	X

Notes:

FHM-TC-SD-004 is a duplicate of FHM-TC-SD-002

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.

Acronyms

MDL - Laboratory Method Detection Limit
mg/kg - Milligrams per kilogram
ND - Not detected at or above MDL

Lab Data Flags:

J - The identification of the analyte is acceptable; the reported value is an estimate.
J5 - The sample matrix interfered with the ability to make any accurate determination; spike value is high
U - Analyte was not detected above the MDL.

Analysis Data Flags:

(A) - Data analysis required use of specific chemical name for lookup
X = Background established value from 2010 sampling event is exceeded.

Table 3-11: Summary Statistics for Metals in Trail Creek Sediments, October 2018

Analyte	CAS Number	Minimun (mg/kg)	Maximum (mg/kg)	Mean (mg/kg)	Standard Deviation (mg/kg)	Background (mg/kg)
Antimony	7440-36-0	ND	ND	ND	ND	ND
Arsenic	7440-38-2	ND	ND	ND	ND	ND
Cadmium	7440-43-9	0.183	3.91	2.22	1.54	0.118
Chromium, Total	7440-47-3	2.37	4.9	3.70	1.04	3.41
Copper	7440-50-8	1.18	1.98	1.55	0.329	0.761
Iron	7439-89-6	4720	7010	6037	966	3720
Lead	7439-92-1	7.11	14.8	10.49	3.21	1.42
Manganese	7439-96-5	173	237	202	26.4	213
Mercury	7439-97-6	ND	ND	ND	ND	ND
Nickel	7440-02-0	1.48	2.54	2.03	0.434	2.11
Selenium	7782-49-2	ND	ND	ND	ND	ND
Silver	7440-22-4	ND	ND	ND	ND	ND
Zinc	7440-66-6	31.1	161	99.0	53.2	16.2

Background – Based on results from sediment sample collected at sampling location FHM-TC-SD-001 in October of 2018.
CAS – Chemical Abstract Services number.
mg/kg – Milligrams per kilogram.
ND = Analyte not detected

Table 3-12: 2018 Surface Water Sampling Results, Total

Analyte	CAS Number	FHM-TC-SW-001 Upgradient Sample			FHM-TC-SW-002				FHM-TC-SW-003				FHM-TC-SW-004			
		Result (mg/L)	Flag	MDL (mg/L)	Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance	Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance	Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance
Metals Analysis																
Antimony	7440-36-0	ND	U	0.0077	ND	U	0.0077		ND	U	0.0077		ND	U	0.0077	
Arsenic	7440-38-2	ND	U	0.0064	ND	U	0.0064		ND	U	0.0064		ND	U	0.0064	
Cadmium	7440-43-9	ND	U	0.0007	ND	U	0.0007		ND	U	0.0007		ND	U	0.0007	
Chromium	7440-47-3	ND	U	0.0018	ND	U	0.0018		ND	U	0.0018		ND	U	0.0018	
Copper	7440-50-8	ND	U	0.007	ND	U	0.007		ND	U	0.007		ND	U	0.007	
Iron	7439-89-6	0.641		0.0282	0.603		0.0282		0.646		0.0282	X	0.615		0.0282	
Lead	7439-92-1	ND	U	0.002	ND	U	0.002		ND	U	0.002		ND	U	0.002	
Manganese	7439-96-5	0.0238		0.002	0.0179		0.002		0.0243		0.002	X	0.0174		0.002	
Mercury	7439-97-6	ND	U	5E-05	ND	U	5E-05		ND	U	5E-05		ND	U	5E-05	
Nickel	7440-02-0	ND	U	0.0058	ND	U	0.0058		ND	U	0.0058		ND	U	0.0058	
Selenium	7782-49-2	ND	U	0.0076	ND	U	0.0076		ND	U	0.0076		ND	U	0.0076	
Silver	7440-22-4	ND	U	0.0027	ND	U	0.0027		ND	U	0.0027		ND	U	0.0027	
Zinc	7440-66-6	ND	U	0.0034	0.0055	J	0.0034	X	0.0053	J	0.0034	X	ND	U	0.0034	
Wet Chemistry																
Hardness as CaCO3		20.5		1.43	20.5		1.43		20.3		1.43		20.6		1.43	X

Notes:

FHM-TC-SW-001 is the upgradient/background water sample
FHM-TC-SW-004 is a duplicate of FHM-TC-SW-002

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.

Acronyms

MDL - Laboratory Method Detection Limit
mg/L - Milligrams per liter
ND - Not detected at or above MDL

Lab Data Flags:

J - The identification of the analyte is acceptable; the reported value is an estimate.
U - Analyte was not detected above the MDL.

Analysis Data Flags:

(A) - Data analysis required use of specific chemical name for lookup
X = Background established value from 2010 sampling event is exceeded.

Table 3-13: 2018 Surface Water Sampling Results, Dissolved

Analyte	CAS Number	FHM-TC-SW-001-D Upgradient Sample			FHM-TC-SW-002-D				FHM-TC-SW-003-D				FHM-TC-SW-004-D			
		Result (mg/L)	Flag	MDL (mg/L)	Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance	Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance	Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance
Metals Analysis																
Antimony	7440-36-0	ND	U	0.0077	ND	U	0.0077		ND	U	0.0077		ND	U	0.0077	
Arsenic	7440-38-2	ND	U	0.0064	ND	U	0.0064		ND	U	0.0064		0.00726	J	0.0064	X
Cadmium	7440-43-9	ND	U	0.0007	ND	U	0.0007		ND	U	0.0007		ND	U	0.0007	
Chromium	7440-47-3	ND	U	0.0018	ND	U	0.0018		0.00184	J	0.0018	X	ND	U	0.0018	
Copper	7440-50-8	ND	U	0.007	ND	U	0.007		0.02		0.007	X	ND	U	0.007	
Iron	7439-89-6	0.451		0.0282	0.415		0.0282		0.464		0.0282	X	0.461		0.0282	X
Lead	7439-92-1	ND	U	0.002	ND	U	0.002		ND	U	0.002		ND	U	0.002	
Manganese	7439-96-5	0.0129		0.002	0.00983	J	0.002		0.014		0.002	X	0.0112		0.002	
Mercury	7439-97-6	ND	U	5E-05	ND	U	5E-05		ND	U	5E-05		ND	U	5E-05	
Nickel	7440-02-0	ND	U	0.0058	ND	U	0.0058		ND	U	0.0058		ND	U	0.0058	
Selenium	7782-49-2	ND	U	0.0076	ND	U	0.0076		ND	U	0.0076		ND	U	0.0076	
Silver	7440-22-4	ND	U	0.0027	ND	U	0.0027		ND	U	0.0027		ND	U	0.0027	
Zinc	7440-66-6	0.0121	J	0.0034	0.0129	J	0.0034	X	0.00874	J	0.0034		ND	U	0.0034	

Notes:

FHM-TC-SW-001 is the upgradient/background water sample
FHM-TC-SW-004-D is a duplicate of FHM-TC-SW-002-D

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.

Acronyms

MDL - Laboratory Method Detection Limit
mg/L - Milligrams per liter
ND - Not detected at or above MDL

Lab Data Flags:

J - The identification of the analyte is acceptable; the reported value is an estimate.
U - Analyte was not detected above the MDL.

Analysis Data Flags:

(A) - Data analysis required use of specific chemical name for lookup
X = Background established value from 2010 sampling event is exceeded.

Table 3-14: Summary Statistics for Total Metals in Trail Creek Surface Water, October 2018

Analyte	CAS Number	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Standard Deviation (mg/L)	Background (mg/L)
Metals Analysis						
Antimony	7440-36-0	ND	ND	ND	ND	ND
Arsenic	7440-38-2	ND	ND	ND	ND	ND
Cadmium	7440-43-9	ND	ND	ND	ND	ND
Chromium	7440-47-3	ND	ND	ND	ND	ND
Copper	7440-50-8	ND	ND	ND	ND	ND
Iron	7439-89-6	0.603	0.646	0.621	0.018	0.641
Lead	7439-92-1	ND	ND	ND	ND	ND
Manganese	7439-96-5	0.0174	0.0243	0.020	0.003	0.0238
Mercury	7439-97-6	ND	ND	ND	ND	ND
Nickel	7440-02-0	ND	ND	ND	ND	ND
Selenium	7782-49-2	ND	ND	ND	ND	ND
Silver	7440-22-4	ND	ND	ND	ND	ND
Zinc	7440-66-6	0.00525	0.00549	0.005	0.0001	ND
Wet Chemistry						
Hardness as CaCO3		20.3	20.6	20.5	0.125	20.5

Background – Based on results from sediment sample collected at sampling location FHM-TC-SW-001 in October of 2018.
CAS – Chemical Abstract Services number.
mg/kg – Milligrams per kilogram.
ND = Analyte not detected

Table 3-15: Summary Statistics for Dissolved Metals Trail Creek Surface Water, October 2018

Analyte	CAS Number	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Standard Deviation (mg/L)	Background (mg/L)
Metals Analysis						
Antimony	7440-36-0	ND	ND	ND	ND	ND
Arsenic	7440-38-2	0.00726	0.00726	0.00726	N/A	ND
Cadmium	7440-43-9	ND	ND	ND	ND	ND
Chromium	7440-47-3	0.00184	0.00184	0.00184	N/A	ND
Copper	7440-50-8	0.02	0.02	0.02	N/A	ND
Iron	7439-89-6	0.415	0.464	0.447	0.0224	0.451
Lead	7439-92-1	ND	ND	ND	ND	ND
Manganese	7439-96-5	0.00983	0.014	0.012	0.00174	0.0129
Mercury	7439-97-6	ND	ND	ND	ND	ND
Nickel	7440-02-0	ND	ND	ND	ND	ND
Selenium	7782-49-2	ND	ND	ND	ND	ND
Silver	7440-22-4	ND	ND	ND	ND	ND
Zinc	7440-66-6	0.00874	0.0129	0.0108	0.00208	0.0121

Background – Based on results from sediment sample collected at sampling location FHM-TC-SW-001 in October of 2018.
CAS – Chemical Abstract Services number.
mg/L– Milligrams per liter.
ND = Analyte not detected

Table 4-1: Applicable or Relevant and Appropriate Requirements and To Be Considered Guidance

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
SURFACE WATER					
1	USFS Forest Management Plan, Subpart A—National Forest System Land Management Planning, 36 CFR Chapter II § 219.10, Multiple Use	The Plan must provide for ecosystem services and multiple uses, including outdoor recreation, range, timber, watershed, wildlife, and fish, within Forest Service authority.	Location Specific	Relevant and Appropriate	Activities shall consider aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish and wildlife species, forage, geologic features, grazing and rangelands, habitat and habitat connectivity, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, timber, trails, vegetation, viewsheds, wilderness, and other relevant resources and uses.
2	Colorado Basic Standards & Methodologies for Surface Water, 5 CCR 1002-31, pursuant to C.R.S. § 25-8-101 et seq.	This regulation establishes statewide surface water quality standards for acceptable concentrations of specified parameters including chemical constituents and pH. The regulation also establishes methodologies for assigning and implementing those standards. Reg 31.	Chemical/ Action Specific	Potentially Applicable	There is no standing surface water/ponds on the site. Removal action goal for site is NOT to clean up nearby Taylor Creek, but to remove exposure pathway(s) for human/ecological risk to surface tailings as well as perform site environmental restoration/ rehabilitation/revegetation. Non-degradation standard. During work, existing water quality in Taylor Creek will not be impacted. Potentially applies only if work occurs near or in Taylor Creek – this will be part of the removal design.

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
3	Mined Land Reclamation Board Regulations for Hard Rock, Metal, and Designated Mining Operations,: Reclamation Performance Standards, 2 CCR 407-1 Rules 3.1.5(10) and (11), pursuant to the Colorado Mined Land Reclamation Act, CRS § 34-32-101 et seq.	All mined material to be disposed of within the affected area must be handled in such a manner so as to prevent any unauthorized release of pollutants to the surface drainage system.	Action Specific	Potentially Applicable	Generally, removal action design will meet substantive requirements of these standards, however, procedural and/or enforcement aspects of these standards are not applicable onsite at an USFS CERCLA removal action. Further, there is no generation and/or placement of any wastes onsite at a CERCLA removal action.
4	Mined Land Reclamation Board Regulations for Hard Rock, Metal, and Designated Mining Operations,: Reclamation Performance Standards, 2 CCR 407-1 Rules 3.1.8, pursuant to the Colorado Mined Land Reclamation Act, CRS § 34-32-101 et seq.	Reclamation activities must consider the safety and protection of wildlife on the mined site and along access roads with special attention given to critical periods in the life cycle of species requiring special consideration (elk calving, migration routes, peregrine falcon nesting, grouse strutting grounds).	Action Specific	Potentially Applicable	Generally, removal action design will meet substantive requirements of these standards, however, procedural and/or enforcement aspects of these standards are not applicable onsite at an USFS CERCLA removal action. Removal action will comply with substantive requirements of Endangered Species Act and consider any state-specific species. Substantively covered by Federal Endangered Species Act
5	Colorado Discharge Permit System (CDPS) Regulations, 5 CCR 1002-61.3(2)(a) and (f)(ii), and CDPS general permit No. COR0300000 (Stormwater discharges associated with construction activity), pursuant to CRS § 25-8-501	Requires implementing management controls through defined “general limitations” and “best management practices” for stormwater pollution prevention pursuant to Colorado Discharge Permit System general permit COR03000002. This permit applies to stormwater discharges from small construction activities, including clearing, grading, and excavating, that result in land disturbance of equal to or greater than one acre and less than five acres.	Action Specific	Applicable	Substantive requirement(s) of regulation apply for any release of stormwater off-site. Design will include a stormwater management plan that meets substantive requirements of ARAR. Procedural and/or enforcement provisions not applicable onsite at an USFS CERCLA removal action.

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
6	CWA Ambient Water Quality Criteria, 40 CFR Part 131, pursuant to 33 USC§§ 1313-1314	Requires EPA and the State to establish ambient water quality control criteria (AWQC) and standards for surface water based on use classifications and the criteria stated under sections 303 and 304(a) of the Clean Water Act.	Chemical Specific	Applicable	Non-degradation standard. During work, existing water quality in Taylor Creek will not be impacted. Potentially applies only if work occurs near or in Taylor Creek – this will be part of the removal design
7	Land Management Plan, Grand Mesa, Uncompahgre, and Gunnison National Forests, 2007	The GMUG Land Management Plan states: "Under the Clean Water Act, the Forest Service is an integral partner and has obligations to meet state water quality standards and beneficial uses". Among the strategies of the Plan are to "participate with State water quality agencies in analysis and assignment of pollutant load allocations when TMDLs are developed that cover 303(d) listed streams on NFS lands".	Chemical Specific	TBC	

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
SOLID AND HAZARDOUS WASTE MANAGEMENT					
8	USFS Forest Management Plan, Subpart A—National Forest System Land Management Planning, 36 CFR Chapter II § 219.10, Multiple Use	The Plan must provide for ecosystem services and multiple uses, including outdoor recreation, range, timber, watershed, wildlife, and fish, within Forest Service authority.	Location Specific	Relevant and Appropriate	Activities shall consider aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish and wildlife species, forage, geologic features, grazing and rangelands, habitat and habitat connectivity, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, timber, trails, vegetation, viewsheds, wilderness, and other relevant resources and uses.
SOIL					
9	MLRB Regulations Rule 3.1.5(1), (3), and (7)	Any grading shall be done in a manner to control erosion and siltation and protect from slides and other damage. High walls shall be stabilized or eliminated. Grading shall create a final topography appropriate to the future land use. Slopes and slope combinations shall be compatible with the configuration of surrounding conditions and future land use.	Action Specific	Applicable	Substantive requirements are applicable onsite, but procedural and/or enforcement aspects of MLRB Regulations are not applicable onsite at an USFS CERCLA removal action. There are no lakes or ponds at this site.

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
10	MLRB Regulations Rule 3.1.5(2)	Backfilling shall ensure adequate compaction for stability and prevent leaching of toxic or acid forming materials.	Action Specific	Potentially Applicable	Groundwater is outside of the scope of this USFS CERCLA removal action.
11	MLRB Regulations Rule 3.1.6	Reclamation activities must minimize disturbances to the prevailing hydrologic balance of the mined land and surrounding area by complying with all laws pertaining to water rights, water quality and dredge and fill activities. Minimizing measures also include removing temporary or large siltation structures from drainageways after stabilization and rehabilitation.	Action Specific	Potentially Applicable	No dredge and fill associated with this project. Substantive reclamation requirements are potentially-applicable and will be included in design. Procedural and/or enforcement aspects of MLRB Regulations are not applicable onsite at an USFS CERCLA removal action.
AIR					
12	Colorado Fugitive Dust Control Plan/Opacity, Regulation No. 1., 5 CCR 1001-3, pursuant to Colorado Air Pollution Prevention and Control Act, CRS § 25-7-101 et seq.	Establishes regulations concerning fugitive emissions from construction activities, storage and stockpiling activities, haul trucks, and tailings ponds.	Action Specific	Potentially Applicable	Substantive requirements of dust control/opacity will be included in design for onsite CERCLA removal action. Compliance with worker safety requirements onsite will preclude any offsite air release(s). Procedural and enforcement provisions do not apply onsite at an USFS CERCLA removal action.
DREDGING OR FILLING OF WETLANDS					
13	CWA Section 404, 33 USC§ 1344, 40 CFR Parts 230 and 231, 33 CFR Part 323	Requires federal agencies to avoid, to the extent possible, adverse impacts associated with destruction or loss of wetlands. Regulates the discharge of dredged or fill material into waters of the U.S. Requires consultation with the Regional Response Team.	Action/ Location Specific	Applicable	Ensure cleanup activities will not impact any wetlands.

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
FLOODPLAINS					
14	Rivers and Harbors Act of 1899, Section 10 Permit, 33 USC§ 403, 33 CFR Parts 320-330	Section 10 Permit required for structures or work in or affecting navigable waters.	Location Specific	Relevant and Appropriate	The regulations will require avoidance of adverse impacts in these areas. Ensure site activities do not impact navigable waters.
15	USFS Forest Management Plan, Subpart A—National Forest System Land Management Planning, 36 CFR Chapter II § 219	Planning requirements for developing, amending, and revising land management plans (also referred to as plans) for units of the National Forest System.	Location Specific	Relevant and Appropriate	
16	Executive Order on Floodplain Management, Exec. Order No. 11998	Limits activities in floodplains, defined as "the lowland and relatively flat areas adjoining inland and coastal waters … including at a minimum, that area subject to a one percent or greater chance of flooding in any given year."	Location Specific	To Be Considered	The Executive order is TBC because it is not a promulgated regulation. The regulations will require avoidance of adverse impacts in these areas. Site activities are not expected to occur near or within in any floodplains.

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
MINING RECLAMATION					
17	USFS Forest Management Plan, Subpart A—National Forest System Land Management Planning, 36 CFR Chapter II § 219.10, Multiple Use	The Plan must provide for ecosystem services and multiple uses, including outdoor recreation, range, timber, watershed, wildlife, and fish, within Forest Service authority.	Location Specific	Relevant and Appropriate	Activities shall consider aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish and wildlife species, forage, geologic features, grazing and rangelands, habitat and habitat connectivity, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, timber, trails, vegetation, viewsheds, wilderness, and other relevant resources and uses.
18	Colorado Noxious Weed Act and Gunnison County Noxious Weed regulations, CRS § 35-5.5-101-119; 8 CCR 1206-2	Removal activities must control the spread of noxious weeds pursuant to this Regulation	Action Specific	Potentially Applicable	Compliance with Forest Plan meets substantive requirements. Procedural and enforcement provisions do not apply onsite at an USFS CERCLA removal action.
19	Colorado Mined Land Reclamation Board Regulations ("MLRB Regulations"), Reclamation Performance Standards, 2 C.C.R. 407-1, Rule 1.1 (definitions) and Rule 3 (Reclamation Performance Standards), pursuant to the Co. Mined Land Reclamation Act, C.R.S. § 34-32-101 et seq	The MLRB Regulations require reclamation of permitted mined lands, defined as "employment of procedures reasonably designed to minimize as much as practicable the disruption from mining operations and to provide for the establishment of plant cover, stabilization of soil, the protection of water resources, or other measures appropriate to the subsequent beneficial use of such affected lands." Reclamation must be conducted in accordance with the performance standards in Rule 3 of the Regulations.	Action Specific	Relevant and Appropriate	Substantive reclamation requirements may be relevant and appropriate. Procedural and/or enforcement aspects of MLRB Regulations are not applicable onsite at an USFS CERCLA removal action.

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
WILDLIFE					
20	USFS Forest Management Plan, Subpart A—National Forest System Land Management Planning, 36 CFR Chapter II § 219.9, Diversity of plant and animal communities.	The Plan must include plan components, including standards or guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, Including: (i) Key characteristics associated with terrestrial and aquatic ecosystem types; (ii) Rare aquatic and terrestrial plant and animal communities; and (iii) The diversity of native tree species similar to that existing in the plan area.	Location Specific	Relevant and Appropriate	The Action must meet the requirements of the Forest Management Plan.
21	Endangered Species Act, 16 USC §§ 1531-1544, 50 CFR Parts 17,402	Protects endangered and threatened species and preserves their habitats, including any modification to critical habitats. Requires coordination with federal agencies for mitigation of impacts.	Location Specific	Applicable	Table 5-1 of the EE/CA identifies potential Threatened and Endangered Species (T&E species) with the potential to use the study area as a habitat. The study area for the Site is not within the critical habitat for any of the T&E or migratory species identified.
22	Fish and Wildlife Coordination Act, 16 USC§§ 661- 666; 40 CFR 6.302(g)	Requires consultation when federal department or agency proposes or authorizes activities affecting or modifying any stream or other water body to provide for adequate provision for protection of fish and wildlife resources.	Location Specific	TBC	Site activities will not affect any stream or other water body.
23	Bald and Golden Eagles Protection Act, 16 USC §§ 668. Et seq.	Prohibits the taking, possession, sale, purchase. Barter, transport, export/import at anytime or in any manner, any bald (American) or any golden eagle, alive or dead, or any part, nest, or egg; establishes civil and criminal penalties (where "take" has been construed to affect habitat as well as physical possession of the eagles).	Action/ Location Specific	Applicable	Activities must avoid actions that affect Bald or Golden Eagles in a manner prohibited by the Act including actions that constitute "taking," "possession" or use."

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
24	Migratory Bird Treaty Act 16 U.S.C. §§ 703 & 707	Establishes federal responsibility for the protection of international migratory bird resources from pursuit, hunt, take, capture or kill from hunters and poachers.	Action Specific	Relevant and Appropriate	Activities must avoid actions that affect migratory birds in a manner prohibited by the Act including actions that constitute "taking," "possession" or "use".
25	Colorado Wildlife Enforcement and Penalties Act, CRS §§ 33-6-101 to 130	Prohibits actions detrimental to wildlife, and establishes provisions governing the taking, possession, hunting and use of wildlife and migratory birds.	Action/ Location Specific	Potentially Applicable	Substantively covered by Federal Endangered Species Act. Generally, removal action design will meet substantive requirements of these standards. Removal action will comply with substantive requirements of Endangered Species Act and consider any state-specific species. Procedural and enforcement provisions may not apply onsite at an USFS CERCLA removal action.
26	Colorado Non-game, Endangered, or Threatened Species Act, CRS §§ 33-2-101-108	Protects endangered and threatened species and preserves their habitats. Requires coordination with the Division of Wildlife if remedial activities impact nongame wildlife deemed to be in need of management.	Action Specific	Potentially Applicable	Substantively covered by Federal Endangered Species Act. Generally, removal action design will meet substantive requirements of these standards, Removal action will comply with substantive requirements of Endangered Species Act and consider any state-specific species. Procedural and enforcement provisions may not apply onsite at an USFS CERCLA removal action.

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
27	Colorado Wildlife Commission Regulations, 2 CCR 406, pursuant to CRS §§ 33-2-101-108	Establishes specific requirements for protection of wildlife.	Action Specific	Potentially Applicable	Substantively covered by Federal Endangered Species Act. Generally, removal action design will meet substantive requirements of these standards, Removal action will comply with substantive requirements of Endangered Species Act and consider any state-specific species. Procedural and enforcement provisions may not apply onsite at an USFS CERCLA removal action.
28	Colorado Natural Areas, CRS § 33-33-104	Maintains a list of plant species of "special concern." Recommends coordination among Division of Parks and Outdoor Recreation.	Action Specific	To Be Considered	Does not meet definition requirements of an ARAR - Not a promulgated regulation.
29	MLRB Regulations Rule 3.1.8	Reclamation activities must consider the safety and protection of wildlife on the mined site and along access roads with special attention given to critical periods in the life cycle of species requiring special consideration (elk calving, migration routes, peregrine falcon nesting, grouse strutting grounds).	Action Specific	Potentially Applicable	Substantively covered by Federal Endangered Species Act. Generally, removal action design will meet substantive requirements of these standards, however, procedural and/or enforcement aspects of these standards are not applicable onsite at an USFS CERCLA removal action. Removal action will comply with substantive requirements of Endangered Species Act and consider any state-specific species.
30	Land Management Plan, Grand Mesa, Uncompahgre, and Gunnison National Forests, 2007	Table 18 of the GMUG Land Management Plan provides federally-listed threatened and endangered species on the GMUG. Plan components for these species comply with the Endangered Species Act.	Location Specific	To Be Considered	

	Standard, Requirement, or Criteria	Description	Type	Potentially ARAR or TBC	Comment
HISTORIC PRESERVATION					
31	Historic and Archeological Data Preservation Act of 1974, 16 USC§ 469	Establishes procedures for preservation of historical and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity.	Location Specific	To Be Considered	The Site is not listed on the National Register of Historic Places.
32	Preservation Regulations, 8 CCR 1504-7, pursuant to CRS 24-80-401 to 410, 1301 to 1305.	Regulates prehistoric and archaeological resources on State lands	Location/Action Specific	Applicable	Substantive compliance with NHPA requirements satisfies this requirement. Procedural and enforcement provisions do not apply onsite at an USFS CERCLA removal action.
WORKER SAFETY AND HEALTH					
33	Occupational Safety and Health Act, 29 USC §§ 651-678	Regulates worker health and safety.	Action Specific	Applicable	Requirements of this Act will apply during site related work activities.

AWQC – Ambient Water Quality Criteria of the Clean Water Act
ARAR – Applicable, or Relevant and Appropriate Requirements, are promulgated requirements that are considered during the feasibility assessment
CERCLA – Comprehensive Environmental Response, Compensation, Liability and Act of 1980
CCR – Code of Colorado Regulations, Colorado state agency regulations
CFR – Code of Federal Regulations, legal code of Colorado
CNAP – Colorado Nature Areas Program, program of Colorado Parks and Wildlife that identifies and protects public areas with unique resources
CRS – Colorado Revised Statutes
CWA – Clean Water Act of 1972
DOT – United States Department of Transportation
MCL – Maximum Contaminant Level of the Safe Drinking Water Act
MCLG – Maximum Contaminant Level Goals of the Safe Drinking Water Act
OSWER – Office of Solid Waste and Emergency Response, USEPA
RCRA – Resource Conservation and Recovery Act of 1976
SDWA – Safe Drinking Water Act
TBC – To Be Considered requirements, that are not promulgated but are provided as guidance, that can be addressed through risk management
T&E – Threatened and Endangered Species, accordance with the Endangered Species Act
USC – United States Code of Laws for the United States of America
USEPA – United States Environmental Protection Agency
Action-Specific – Requirements that must be considered during the construction process of the removal action.
Chemical-Specific – Requirements that are based on the nature and extent of the chemical COPC identified onsite

Location-Specific – Requirement that are based on the location where the removal action will take place, including zoning requirements, permitting, natural and cultural resource impacts.

Table 5-1: Human Health Risk-Based Screening Levels

Analyte	CAS Number[1]	Soil			Water		
		BLM Camper SL[2] (mg/kg)	USEPA RSL Residential[3] (mg/kg)	USEPA RSL Industrial[4] (mg/kg)	USEPA Tap water RSL[5] (mg/L)	Colorado Drinking Water[6] (mg/L)	USEPA MCL[7] (mg/L)
Antimony	7440-36-0	782	31	470	0.0078	0.006	0.006
Arsenic[8]	7440-38-2	31	0.68	3.0	0.000052	0.0002	0.01
Barium	7440-39-3	390,000	15,000	220,000	3.8	0.49	2
Beryllium	7440-41-7	3,910	160	2,300	0.025	0.004	0.004
Cadmium	7440-43-9	1,780	71	980	0.0092	0.005	0.005
Chromium	7440-47-3	1,000,000	120,000	1,800,000	22	No SL	0.1
Copper	7440-50-8	78,200	3,100	47,000	0.8	1.0	1.3
Iron	7439-89-6	1,000,000	55,000	820,000	14	0.3	No SL
Lead	7439-92-1	800	400	800	0.015	0.05	0.015
Manganese	7439-96-5	46,700	1,800	26,000	0.43	0.05	No SL
Mercury	7439-97-6	271	11	46	0.00063	0.002	0.002
Nickel	7440-02-0	39,000	1,500	22,000	0.39	0.1	No SL
Selenium	7782-49-2	9,780	390	5,800	0.1	0.05	0.05
Silver	7440-22-4	9,780	390	5,800	0.094	0.1	No SL
Thallium	7440-28-0	19.6	0.78	12	No RSL	No SL	0.002
Vanadium	7440-62-2	9,850	390	5,800	0.0002	0.0005	No SL
Zinc	7440-66-6	587,000	23,000	350,000	0.086	No SL	No SL

[1] CAS Number – Chemical Abstract Service Lookup numbers unique to each chemical.
[2] Bureau of Land Management Recreational Camper Screening Level (SL), (Cox 2017)
[3] USEPA Regional Screening Levels (RSLs) Residential Soil, (USEPA, 2018)
[4] USEPA Regional Screening Levels (RSLs) Industrial Soil, (USEPA, 2018)
[5] USEPA Regional Screening Levels (RSLs) Tap water, (USEPA, 2018)
[6] Colorado Department of Public Health and the Environment (CDPHE), Regulation No. 31, Table III. Metal Parameters, Domestic Water Supply
[7] USEPA Maximum Contaminant Level (MCL), National Primary Drinking Water Regulations are enforceable drinking water standards
[8] Arsenic is a carcinogen and the given risk-based standards are based on 1 x 10^{-6} lifetime cancer risk for the given exposure scenario
mg/kg – milligrams per kilogram
mg/L – Milligrams per liter

Table 5-2. Forest Hill Study Area Surface Soil Results Compared to Risk-Based Screening Levels for Human Health

Analyte	CAS Number	Background Soil FH-BKG SED						2018 Soil FHM-FMU-SS-001						2018 Soil FHM-FML-SS-001					
						USEPA						USEPA						USEPA	
		Result (mg/kg)	Flag	MDL (mg/kg)	BLM Recreational SL	Residential	Industrial	Result (mg/kg)	Flag	MDL (mg/kg)	BLM Recreational SL	Residential	Industrial	Result (mg/kg)	Flag	MDL (mg/kg)	BLM Recreational SL	Residential	Industrial
Metals Analysis																			
Antimony [1]	7440-36-0	ND	U	0.2	0	0	0	5.96	J3 J6	0.75	0	0	0	113		0.75	0	4	0
Arsenic [2]	7440-38-2	2.90		0.30	0	4	1	10.00		0.46	0	15	3	64.6		0.46	2	95	22
Cadmium [1]	7440-43-9	0.25	B	0.05	0	0	0	20.2	J3	0.07	0	0	0	263		0.07	0	4	0
Copper [1]	7440-50-8	9		1	0	0	0	83.4	O1	0.53	0	0	0	290		0.53	0	0	0
Lead [1]	7439-92-1	16	B	4	0	0	0	932	V	0.19	1	2	1	8350		0.19	10	21	10
Mercury [1]	7439-97-6	ND	U	0.04	0	0	0	0.0992	J6	0.0028	0	0	0	6.44		0.028	0	1	0
Silver [1]	7440-22-4	0.07	B	0.03	0	0	0	6.32		0.12	0	0	0	94.2		0.12	0	0	0
Zinc [1]	7440-66-6	72		1	0	0	0	1360	J3 O1 V	0.59	0	0	0	29800		11.8	0	1	0

Analyte	CAS Number	Tailings FH-TL-1						2018 Soil FHM-MTA-2-SS-001						2018 Soil FHM-UA-SS-001					
						USEPA						USEPA						USEPA	
		Result (mg/kg)	Flag	MDL (mg/kg)	BLM Recreational SL	Residential	Industrial	Result (mg/kg)	Flag	MDL (mg/kg)	BLM Recreational SL	Residential	Industrial	Result (mg/kg)	Flag	MDL (mg/kg)	BLM Recreational SL	Residential	Industrial
Metals Analysis																			
Antimony [1]	7440-36-0	216		4	0	7	0	26.6		0.75	0	1	0	27		0.75	0	1	0
Arsenic [2]	7440-38-2	135		5.00 *	4	199	45	26.6		0.46	1	39	9	24.9		0.46	1	37	8
Cadmium [1]	7440-43-9	63		1	0	1	0	30.1		0.07	0	0	0	32.1		0.07	0	0	0
Copper [1]	7440-50-8	243		1	0	0	0	161		0.53	0	0	0	167		0.53	0	0	0
Lead [1]	7439-92-1	14200		4	18	36	18	3110		0.19	4	8	4	2990		0.19	4	7	4
Mercury [1]	7439-97-6	2.2		0.04	0	0	0	0.332		0.0028	0	0	0	0.401		0.0028	0	0	0
Silver [1]	7440-22-4	134		0.5	0	0	0	31.4		0.12	0	0	0	29.6		0.12	0	0	0
Zinc [1]	7440-66-6	8080		1	0	0	0	1960		2.95	0	0	0	2000		2.95	0	0	0

Analyte		CAS Number	2018 Soil FHM-UWA1-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	BLM Recreational SL	USEPA Residential	USEPA Industrial	2018 Soil FHM-UWA2-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	BLM Recreational SL	USEPA Residential	USEPA Industrial	2018 Soil FHM-LW1-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	BLM Recreational SL	USEPA Residential	USEPA Industrial
Metals Analysis																				
Antimony	[1]	7440-36-0	72.8		1.17	0	2	0	7.51		0.75	0	0	0	4.75		0.75	0	0	0
Arsenic	[2]	7440-38-2	60.9		0.72 *	2	90	20	8.68		0.46	0	13	3	6.47		0.46	0	10	2
Cadmium	[1]	7440-43-9	40.1		0.109	0	1	0	42.4		0.07	0	1	0	19.2		0.07	0	0	0
Copper	[1]	7440-50-8	258		0.828	0	0	0	90.9		0.53	0	0	0	70.3		0.53	0	0	0
Lead	[1]	7439-92-1	4910		0.297	6	12	6	933		0.19	1	2	1	496		0.19	1	1	1
Mercury	[1]	7439-97-6	1.35		0.0056	0	0	0	0.0875		0.0028	0	0	0	0.0641		0.0028	0	0	0
Silver	[1]	7440-22-4	57.1		0.188	0	0	0	7.41		0.12	0	0	0	3.28		0.12	0	0	0
Zinc	[1]	7440-66-6	3300		4.61	0	0	0	2140		2.95	0	0	0	687		0.59	0	0	0

Analyte		CAS Number	2018 Soil FHM-LWA2-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	BLM Recreational SL	USEPA Residential	USEPA Industrial
Metals Analysis								
Antimony	[1]	7440-36-0	5		0.75	0	0	0
Arsenic	[2]	7440-38-2	6.99		0.46	0	10	2
Cadmium	[1]	7440-43-9	23		0.07	0	0	0
Copper	[1]	7440-50-8	64.4		0.53	0	0	0
Lead	[1]	7439-92-1	557		0.19	1	1	1
Mercury	[1]	7439-97-6	0.0594		0.0028	0	0	0
Silver	[1]	7440-22-4	4.83		0.12	0	0	0
Zinc	[1]	7440-66-6	1210		0.59	0	0	0

Notes:

FHM-UA-SS-001 is a duplicate of FHM-MTA-2-SS-01
Scientific notation used specifically to indicate values that contribute to lifetime cancer risk calculations
HQ and HI values are represented to one significant digit

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.
USEPA Regional Screening Levels (RSLs) Residential Soil, (USEPA, 2018)
USEPA Regional Screening Levels (RSLs) Industrial Soil, (USEPA, 2018)

Acronyms

MDL - Laboratory Method Detection Limit
mg/kg - Milligrams per kilogram

ND - Not detected at or above MDL
RSL - Regional Screening Levels

Lab Data Flags:

B - Result is an estimated value.
J - The identification of the analyte is acceptable; the reported value is an estimate.
J3 - The associated batch QC was outside the established quality control range for precision.
J6 - The sample matrix interfered with the ability to make any accurate determination; spike value is low.
O1 - The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference
U - Analyte was not detected above the MDL.
V - The sample concentration is too high to evaluate accurate spike recoveries.

Analysis Data Flags:

* - MDL exceeds the PSL
[1] – Non-carcinogenic compound
[2] – Carcinogenic compound

Table 5-3. Forest Hill Study Area Surface Water Total Results Compared to Risk-Based Screening Levels for Human Health

Analyte	CAS Number	FHM-TC-SW-001 Upgradient Sample					FHM-TC-SW-002				
		Result (mg/L)	Flag	MDL (mg/L)	EPA Tapwater	CO Drinking Water	Result (mg/L)	Flag	MDL (mg/L)	EPA Tapwater	CO Drinking Water
Metals Analysis											
Arsenic	7440-38-2	ND	U	0.0064 *	123	32	ND	U	0.0064 *	123	32
Copper	7440-50-8	ND	U	0.007	0	0	ND	U	0.007	0	0

Analyte	CAS Number	FHM-TC-SW-003					FHM-TC-SW-004				
		Result (mg/L)	Flag	MDL (mg/L)	EPA Tapwater	CO Drinking Water	Result (mg/L)	Flag	MDL (mg/L)	EPA Tapwater	CO Drinking Water
Metals Analysis											
Arsenic	7440-38-2	ND	U	0.0064 *	123	32	ND	U	0.0064 *	123	32
Copper	7440-50-8	ND	U	0.007	0	0	ND	U	0.007	0	0

Notes:

FHM-TC-SW-004 is a duplicate of FHM-TC-SW-002
Scientific notation used specifically to indicate values that contribute to lifetime cancer risk calculations
HQ and HI values are represented to one significant digit

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.
USEPA Regional Screening Levels (RSLs) Tap water, (USEPA, 2018)

Acronyms

MDL - Laboratory Method Detection Limit
mg/L - Milligrams per liter
ND - Not detected at or above MDL

Lab Data Flags:

J - The identification of the analyte is acceptable; the reported value is an estimate.
U - Analyte was not detected above the MDL.

Analysis Data Flags:

* - MDL exceeds risk SL

Table 5-4. Forest Hill Study Area Surface Water Dissolved Results Compared to Risk-Based Screening Levels for Human Health

Analyte	CAS Number	FHM-TC-SW-001-D Upgradient Sample					FHM-TC-SW-002-D				
		Result (mg/L)	Flag	MDL (mg/L)	EPA Tapwater	CO Drinking Water	Result (mg/L)	Flag	MDL (mg/L)	EPA Tapwater	CO Drinking Water
Metals Analysis											
Arsenic	7440-38-2	ND	U	0.0064 *	123	32	ND	U	0.0064 *	123	32
Copper	7440-50-8	ND	U	0.007	0	0	ND	U	0.007	0	0

Analyte	CAS Number	FHM-TC-SW-003-D					FHM-TC-SW-004-D				
		Result (mg/L)	Flag	MDL (mg/L)	EPA Tapwater	CO Drinking Water	Result (mg/L)	Flag	MDL (mg/L)	EPA Tapwater	CO Drinking Water
Metals Analysis											
Arsenic	7440-38-2	ND	U	0.0064 *	123	32	0.00726	J	0.0064 *	140	36
Copper	7440-50-8	0.02		0.007	0	0	ND	U	0.007	0	0

Notes:

FHM-TC-SW-004 is a duplicate of FHM-TC-SW-002
Scientific notation used specifically to indicate values that contribute to lifetime cancer risk calculations
HQ and HI values are represented to one significant digit

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.
USEPA Regional Screening Levels (RSLs) Tap water, (USEPA, 2018)

Acronyms

MDL - Laboratory Method Detection Limit
mg/L - Milligrams per liter
ND - Not detected at or above MDL

Lab Data Flags:

J - The identification of the analyte is acceptable; the reported value is an estimate.
U - Analyte was not detected above the MDL.

Analysis Data Flags:

* - MDL exceeds risk SL

Table 5-5. Potential Threatened or Endangered Ecological Receptors in the Forest Hill Study Area

Common & Scientific Species Name	Status	Potential to Occur in Forest Hill Study Area	Rationale for Exclusion	Habitat Description and Range in Colorado
Mammals				
Canada Lynx (*Lynx canadensis*)	T	Yes	Location is outside the critical habitat.	The distribution of lynx in North America is closely associated with the distribution of North American boreal forest. The range of lynx populations extends south from the classic boreal forest zone into the subalpine forest of the western United States, and the boreal/hardwood forest ecotone in the eastern United States. Forests with boreal features extend south into the contiguous United States along the North Cascade and Rocky Mountain Ranges in the west. Within these general forest types, lynx are most likely to persist in areas that receive deep snow and have high-density populations of snowshoe hares, the principal prey of lynx.
North American Wolverine (*Gulo gulo luscus*)	P	Yes		Wolverines occur in alpine and subalpine mature/intermediate timbered areas around natural openings, including cliffs, slides, basins, and meadows. They are dependent on ungulates and historically occur along the Rocky Mountains in Colorado.
Birds				
Gunnison Sage-grouse (*Centrocercus minimus*)	T	Yes		Gunnison Sage-grouse can be found in tall, dense stands of sagebrush near wet meadows with tall grasses for hiding. They occur primarily in southwest and western Colorado; their range also includes Saguache and south Chaffee counties.

Common & Scientific Species Name	Status	Potential to Occur in Forest Hill Study Area	Rationale for Exclusion	Habitat Description and Range in Colorado
Fish				
Bonytail Chub (*Gila elegans)*	E	No	Warm water habitat not found at site	
Colorado Pikeminnow (squawfish) (*Ptychocheilus lucius*)	E	No	Warm water habitat not found at site	
Greenback Cutthroat Trout (*Oncorhynchus clarkii stomias*)	T	No		Greenback cutthroat trout are cold-water fish belonging to the trout, salmon and whitefish family. They have dark, round spots on the sides and tail and two colorful blood-red stripes on each side of the throat under the jaw, hence the name "cutthroat." During the spring spawning season, the entire belly may become crimson red. The species historical range included Colorado, Utah.
Humpback Chub (*Gila cypha*)	E	No	Warm water habitat not found at site	
Razorback Sucker (*Xryauchen texanus*)	E	No	Warm water habitat not found at site	

Data from https://ecos.fws.gov/ipac/project/RM4ZMMSHLVGZRBGHSCD74HICSY/index#. See Appendix E.
E – Endangered
P – Proposed Threatened
T – Threatened
M – Migratory Bird

Table 5-6. Ecological Risk-Based Standards

Analyte	CAS Number [1]	Soil		Water	
		NPS ESV Birds & Mammals [2] (mg/kg)	NPS ESV Plants & Invertebrates [3] (mg/kg)	NRWQC Chronic [4] (mg/L)	Refined SLERA ESVs [5] (mg/L)
Antimony	7440-36-0	0.27	5	No ESV	**0.03**
Arsenic	7440-38-2	43	18	0.15	0.15
Barium	7440-39-3	820	330	No ESV	0.004
Beryllium	7440-41-7	21	10	No ESV	0.00066
Cadmium	7440-43-9	0.36	32	0.00013	TVS
Chromium	7440-47-3	28	0.4	0.0349	0.0349
Copper	7440-50-8	28	70	0.0016	TVS
Lead	7439-92-1	11	120	0.000916	TVS
Manganese	7439-96-5	4,000	220	No ESV	0.12
Mercury	7439-97-6	0.01	0.10	0.00077	0.00077
Nickel	7440-02-0	130	38	0.0239	TVS
Selenium	7782-49-2	1	1	0.005	0.005
Silver	7440-22-4	4	560	6.65E-05	TVS
Thallium	7440-28-0	0.22	1	No ESV	0.012
Vanadium	7440-62-2	8	2	No ESV	0.02
Zinc	7440-66-6	46	120	0.054352393	TVS

[1] CAS Number – Chemical Abstract Service Lookup numbers unique to each chemical.
[2] National Park Service environmental screening values for birds and mammals (NPS, 2016)
[3] National Park Service environmental screening values for plants and invertebrates (NPS, 2016)
[4] USEPA National Recommended Water Quality Criteria- Chronic, 2015, freshwater aquatic biology
[5] Chronic ESVs that are selected based on the hierarchy described in NPS, 2016.
mg/kg – milligrams per kilogram
mg/L – Milligrams per liter
TVS – Table Value Standards, based on water hardness for site specific values, freshwater aquatic biology.

Table 5-7. Table Value Standard Coefficients from WQCC Regulation No. 35

Metal	CAS No.	A	B	C	D
Cadmium	7440-43-9	1.101672	0.041838	0.7998	-4.4451
Chromium (III)	7440-47-3	1	0	0.819	0.534
Copper	7440-50-8	1	0	0.8545	-1.7428
Lead	7439-92-1	1.46203	0.145712	1.273	-4.705
Manganese	7439-96-5	1	0	0.3331	5.8743
Nickel	7440-02-0	1	0	0.846	0.0554
Selenium	7782-49-2	4.6	0	0	0
Silver[1]	7440-22-4	1	0	1.72	-10.51
Uranium	7440-61-1	1	0	1.1021	2.2382
Zinc	7440-66-6	1	0	2.14	-5.084

[1] Chronic (Trout)

Table 5-8. Forest Hill Study Area Surface Soil Results Compared to Risk-Based Screening Levels for Ecological Health

Analyte	CAS Number	Background Soil FH-BKG SED					2018 Soil FHM-FMU-SS-001					2018 Soil FHM-FML-SS-001				
					NPS					NPS					NPS	
		Result (mg/kg)	Flag	MDL (mg/kg)	B&M	P&I	Result (mg/kg)	Flag	MDL (mg/kg)	B&M	P&I	Result (mg/kg)	Flag	MDL (mg/kg)	B&M	P&I
Metals Analysis																
Antimony	7440-36-0	ND	U	0.20	**1**	0	5.96	J3 J6	0.75 *	**22**	**1**	113		0.75 *	**419**	**23**
Arsenic	7440-38-2	2.9		0.30	0	0	10		0.46	0	**1**	64.6		0.46	**2**	**4**
Cadmium	7440-43-9	0.25	B	0.05	**1**	0	20.2	J3	0.07	**56**	**1**	263		0.07	**731**	**8**
Copper	7440-50-8	9		1.00	0	0	83.4	O1	0.53	**3**	**1**	290		0.53	**10**	**4**
Lead	7439-92-1	16	B	4.00	**1**	0	932	V	0.19	**85**	**8**	8350		0.19	**759**	**70**
Mercury	7439-97-6	ND	U	0.04 *	**3**	0	0.0992	J6	0.0028	**8**	**1**	6.44		0.028 *	**495**	**64**
Silver	7440-22-4	0.07	B	0.03	0	0	6.32		0.12	**2**	0	94.2		0.12	**22**	0
Zinc	7440-66-6	72		1.00	**2**	**1**	1360	J3 O1 V	0.59	**30**	**11**	29800		11.8	**648**	**248**

Analyte	CAS Number	Tailings FH-TL-1					2018 Soil FHM-MTA-2-SS-001					2018 Soil FHM-UA-SS-001				
					NPS					NPS					NPS	
		Result (mg/kg)	Flag	MDL (mg/kg)	B&M	P&I	Result (mg/kg)	Flag	MDL (mg/kg)	B&M	P&I	Result (mg/kg)	Flag	MDL (mg/kg)	B&M	P&I
Metals Analysis																
Antimony	7440-36-0	216		4.00 *	**800**	**43**	26.6		0.75 *	**99**	**5**	27		0.75 *	**100**	**5**
Arsenic	7440-38-2	135		5.00	**3**	**8**	26.6		0.46	**1**	**1**	24.9		0.46	**1**	**1**
Cadmium	7440-43-9	63		1.00 *	**175**	**2**	30.1		0.07	**84**	**1**	32.1		0.07	**89**	**1**
Copper	7440-50-8	243		1.00	**9**	**3**	161		0.53	**6**	**2**	167		0.53	**6**	**2**
Lead	7439-92-1	14200		4.00	**1291**	**118**	3110		0.19	**283**	**26**	2990		0.19	**272**	**25**
Mercury	7439-97-6	2.2		0.04 *	**169**	**22**	0.332		0.0028	**26**	**3**	0.401		0.0028	**31**	**4**
Silver	7440-22-4	134		0.50	**32**	0	31.4		0.12	**7**	0	29.6		0.12	**7**	0
Zinc	7440-66-6	8080		1.00	**176**	**67**	1960		2.95	**43**	**16**	2000		2.95	**43**	**17**

Analyte	CAS Number	2018 Soil FHM-UWA1-SS-001			NPS		2018 Soil FHM-UWA2-SS-001			NPS		2018 Soil FHM-LW1-SS-001			NPS	
		Result (mg/kg)	Flag	MDL (mg/kg)	B&M	P&I	Result (mg/kg)	Flag	MDL (mg/kg)	B&M	P&I	Result (mg/kg)	Flag	MDL (mg/kg)	B&M	P&I
Metals Analysis																
Antimony	7440-36-0	72.8		1.17 *	270	15	7.51		0.75 *	28	2	4.75		0.75 *	18	1
Arsenic	7440-38-2	60.9		0.719	1	3	8.68		0.46	0	0	6.47		0.46	0	0
Cadmium	7440-43-9	40.1		0.109	111	1	42.4		0.07	118	1	19.2		0.07	53	1
Copper	7440-50-8	258		0.828	9	4	90.9		0.53	3	1	70.3		0.53	3	1
Lead	7439-92-1	4910		0.297	446	41	933		0.19	85	8	496		0.19	45	4
Mercury	7439-97-6	1.35		0.0056	104	14	0.0875		0.0028	7	1	0.0641		0.0028	5	1
Silver	7440-22-4	57.1		0.188	14	0	7.41		0.12	2	0	3.28		0.12	1	0
Zinc	7440-66-6	3300		4.61	72	28	2140		2.95	47	18	687		0.59	15	6

Analyte	CAS Number	2018 Soil FHM-LWA2-SS-001			NPS	
		Result (mg/kg)	Flag	MDL (mg/kg)	B&M	P&I
Metals Analysis						
Antimony	7440-36-0	5		0.75 *	19	1
Arsenic	7440-38-2	6.99		0.46	0	0
Cadmium	7440-43-9	23		0.07	64	1
Copper	7440-50-8	64.4		0.53	2	1
Lead	7439-92-1	557		0.19	51	5
Mercury	7439-97-6	0.0594		0.0028	5	1
Silver	7440-22-4	4.83		0.12	1	0
Zinc	7440-66-6	1210		0.59	26	10

Notes:

FHM-UA-SS-001 is a duplicate of FHM-MTA-2-SS-01
FH-TL-1 included as a surrogate for an FHM-MTA-1-SS-01 sample
HQ and HI values are represented to one significant digit

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical
ESV - Environmental screening value
ESV (B&M) - National Park Service Environmental screening values for Birds and Mammals (NPS, 2016)

ESV (P&I) - National Park Service Environmental screening values for Plants and Invertebrates (NPS, 2016)

Acronyms

MDL - Laboratory Method Detection Limit
mg/kg - Milligrams per kilogram
ND - Not detected at or above MDL

Lab Data Flags:

B - Result is an estimated value.
J - The identification of the analyte is acceptable; the reported value is an estimate.
J3 - The associated batch QC was outside the established quality control range for precision.
J6 - The sample matrix interfered with the ability to make any accurate determination; spike value is low.
O1 - The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference
U - Analyte was not detected above the MDL.
V - The sample concentration is too high to evaluate accurate spike recoveries.

Analysis Data Flags:

* - MDL exceeds the PSL

Table 5-9. Forest Hill Study Area Sediment Results Compared to Risk-Based Screening Levels for Ecological Health

Analyte	CAS Number	2018 Upgradient Sediment FHM-TC-SD-001				2018 Sediment FHM-TC-SD-002				2018 Sediment FHM-TC-SD-003				2018 Sediment FHM-TC-SD-004			
		Result (mg/kg)	Flag	MDL (mg/kg)	NPS Sediments	Result (mg/kg)	Flag	MDL (mg/kg)	NPS Sediments	Result (mg/kg)	Flag	MDL (mg/kg)	NPS Sediments	Result (mg/kg)	Flag	MDL (mg/kg)	NPS Sediments
Metals Analysis																	
Antimony	7440-36-0	ND	U	0.75 *		ND	U	0.75 *		ND	U	0.75 *		ND	U	0.75 *	
Arsenic	7440-38-2	ND	U	0.46	0	ND	U	0.46	0	ND	U	0.46	0	ND	U	0.46	0
Cadmium	7440-43-9	0.118	J	0.07	0	2.57		0.07	**1**	0.183	J	0.07	0	3.91		0.07	**1**
Copper	7440-50-8	0.761	J	0.53	0	1.49	J	0.53	0	1.18	J	0.53	0	1.98	J	0.53	0
Lead	7439-92-1	1.42		0.19	0	9.57		0.19	0	14.8		0.19	0	7.11		0.19	0
Mercury	7439-97-6	ND	U	0.0028		ND	U	0.0028		ND	U	0.0028		ND	U	0.0028	
Silver	7440-22-4	ND	U	0.12		ND	U	0.12		ND	U	0.12		ND	U	0.12	
Zinc	7440-66-6	16.2		0.59	0	105		0.59	0	31.1		0.59	0	161		0.59	0

Notes:

FHM-TC-SD-004 is a duplicate of FHM-TC-SD-002

HQ and HI values are represented to one significant digit

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical.

ESV (B&M) - National Park Service Environmental screening values for Birds and Mammals (NPS, 2016)

ESV (P&I) - National Park Service Environmental screening values for Plants and Invertebrates (NPS, 2016)

Acronyms

MDL - Laboratory Method Detection Limit

mg/kg - Milligrams per kilogram

ND - Not detected at or above MDL

SL - Screening Level

Lab Data Flags:

J - The identification of the analyte is acceptable; the reported value is an estimate.

J5 - The sample matrix interfered with the ability to make any accurate determination; spike value is high

U - Analyte was not detected above the MDL.

Analysis Data Flags:

* - MDL exceeds the PSL

Table 5-10. Forest Hill Study Area Surface Water Total Results Compared to Risk-Based Screening Levels for Ecological Health

Analyte	CAS Number	FHM-TC-SW-001 Upgradient Sample							FHM-TC-SW-002						
		Result (mg/L)	Flag	MDL (mg/L)	Site Specific Sandard (mg/L)	Site-Specific	NRWQC	SLERA ESV	Result (mg/L)	Flag	MDL (mg/L)	Site Specific Sandard (mg/L)	Site-Specific	NRWQC	SLERA ESV
Metals Analysis															
Arsenic	7440-38-2	ND	U	0.0064	0.15	0	0	0	ND	U	0.0064	0.15	0	0	0
Copper	7440-50-8	ND	U	0.007 ^*	0.0023 +	3	4		ND	U	0.007 ^*	0.0023 +	3	4	

Analyte	CAS Number	FHM-TC-SW-003							FHM-TC-SW-004						
		Result (mg/L)	Flag	MDL (mg/L)	Site Specific Sandard (mg/L)	Site-Specific	NRWQC	SLERA ESV	Result (mg/L)	Flag	MDL (mg/L)	Site Specific Sandard (mg/L)	Site-Specific	NRWQC	SLERA ESV
Metals Analysis															
Arsenic	7440-38-2	ND	U	0.0064	0.15	0	0	0	ND	U	0.0064	0.15	0	0	0
Copper	7440-50-8	ND	U	0.007 ^*	0.0023 +	3	4		ND	U	0.007 ^*	0.0023 +	3	4	

Notes:

FHM-TC-SW-004-D is a duplicate of FHM-TC-SW-002-D
HQ and HI values are represented to one significant digit

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical
ESV - Ecological Screening Values
NRWQC - National Recommended Water Quality Criteria
SLERA - Screening Level Ecological Risk Assessment

Acronyms

MDL - Laboratory Method Detection Limit
mg/L - Milligrams per liter
ND - Not detected at or above MDL

Lab Data Flags:

J - The identification of the analyte is acceptable; the reported value is an estimate.
U - Analyte was not detected above the MDL.

Table 5-11. Forest Hill Study Area Surface Water Dissolved Results Compared to Risk-Based Screening Levels for Ecological Health

Analyte	CAS Number	FHM-TC-SW-001-D Upgradient Sample							FHM-TC-SW-002-D						
		Result (mg/L)	Flag	MDL (mg/L)	Site Specific Sandard (mg/L)	Site-Specific	NRWQC	SLERA ESV	Result (mg/L)	Flag	MDL (mg/L)	Site Specific Sandard (mg/L)	Site-Specific	NRWQC	SLERA ESV
Metals Analysis															
Arsenic	7440-38-2	ND	U	0.0064	0.15	0	0	0	ND	U	0.0064	0.15	0	0	0
Copper	7440-50-8	ND	U	0.007 ^*	0.0023 +	3	4		ND	U	0.007 ^*	0.0023 +	3	4	

Analyte	CAS Number	FHM-TC-SW-003-D							FHM-TC-SW-004-D						
		Result (mg/L)	Flag	MDL (mg/L)	Site Specific Sandard (mg/L)	Site-Specific	NRWQC	SLERA ESV	Result (mg/L)	Flag	MDL (mg/L)	Site Specific Sandard (mg/L)	Site-Specific	NRWQC	SLERA ESV
Metals Analysis															
Arsenic	7440-38-2	ND	U	0.0064	0.15	0	0	0	0.00726	J	0.0064	0.15	0	0	0
Copper	7440-50-8	0.02		0.007 ^*	0.0023 +	9	13		ND	U	0.007 ^*	0.0023 +	3	4	

Notes:

FHM-TC-SW-004-D is a duplicate of FHM-TC-SW-002-D
HQ and HI values are represented to one significant digit

Risk Screening Information and References

CAS Number - Chemical Abstract Service Lookup numbers unique to each chemical
ESV - Ecological Screening Values
NRWQC - National Recommended Water Quality Criteria
SLERA - Screening Level Ecological Risk Assessment

Acronyms

MDL - Laboratory Method Detection Limit
mg/L - Milligrams per liter
ND - Not detected at or above MDL

Lab Data Flags:

J - The identification of the analyte is acceptable; the reported value is an estimate.
U - Analyte was not detected above the MDL.

Table 7-1. Estimated Waste Volume compared to Estimated Onsite Repository Capacity

Exposure Unit	Area (SY)	Estimated Thickness (Yards)		Estimated Volume (CY)	
		Min	Max	Min	Max
Former Mill (Upper)	124	0.33	0.67	41	83
Former Mill (Lower)	850	0.3	1.3	283	1,133
Main Tailings Area 1	15,049	0.11	0.33	1,672	5,016
Main Tailings Area 2	5,687	0.06	0.11	316	632
Upper Washout Area 1	2,263	0.06	0.11	126	251
Upper Washout Area 2	2,360	0.03	0.06	66	131
Lower Washout Area 1	8,941	0.03	0.17	248	1,490
Lower Washout Area 2	9,443	0.03	0.17	262	1,574
Total	**44,717**			**3,015**	**10,311**

Repository	Area (SY)	Estimated Thickness (Yards)	Estimated Capacity (CY)
Repository East	4,153	2	8,306
Repository West	5,452	2	10,904
Total	**9,605**		**19,210**

Note: Assumes minimum 2-feet thick impermeable cap over waste materials; the additional volume excavated from the repository would be used as clean backfill at former AOC**s.**

Table 7-2: Removal Action Construction Cost Comparison

Item	Estimated Cost [1]	Alternative 1 On-Site Repository with Impermeable Cap		Alternative 2 Off-Site Repository		Alternative 3 No Action	
		Units	Cost	Units	Cost	Units	Cost
Mob-Demobilizations:		**Sum**	**$21,900**		**$19,500**		
Excavator Mobilization	$3,500 Fixed	1	$3,500	1	$3,500		
Backhoe Mobilization	$2,000 Fixed	1	$2,000	1	$2,000		
Front Loader Mobilization	$3,500 Fixed	1	$3,500	1	$3,500		
Grader Mob-Mobilization	$3,500 Fixed	1	$3,500	1	$3,500		
Light Dozer Mob-Mobilization	$3,500 Fixed	1	$3,500	1	$3,500		
Light Truck Mob-Mobilization	$800 Fixed	3	$2,400	0	$0		
Compactor Mob-Mobilization	$3,500 Fixed	1	$3,500	1	$3,500		
Surveying	lump sum	1	**$15,000**	1	**$15,000**		
Stormwater and Erosion Controls	lump sum	1	**$8,000**	1	**$8,000**		
Construction Access Road to Mill Site			**$24,000**		**$24,000**		
Excavator	$250 /hr	30	$7,500	30	$7,500		
Light Dozer	$150 /hr	50	$7,500	50	$7,500		
Front Loader	$100 /hr	50	$5,000	50	$5,000		
Light Truck (1)	$100 /hr	40	$4,000	40	$4,000		
Access Road to On-Site Repository			**$7,600**		**$0**		
Light Dozer	$150 /hr	16	$2,400	0	$0		
Grader	$250 /hr	16	$4,000	0	$0		
Light Truck (1)	$100 /hr	12	$1,200	0	$0		
Excavate On-Site Repository, construct perimeter stormwater controls			**$86,000**		**$0**		
Excavator	$250 /hr	140	$35,000	0	$0		
Light Dozer	$150 /hr	160	$24,000	0	$0		

Item	Estimated Cost [1]	Alternative 1 On-Site Repository with Impermeable Cap		Alternative 2 Off-Site Repository		Alternative 3 No Action	
		Units	Cost	Units	Cost	Units	Cost
Front Loader	$100 /hr	160	$16,000	0	$0		
Light Truck	$100 /hr	1100	$11,000	0	$0		
Excavate/Load and Transport Wastes for On-Site Disposal			**$116,000**	0	**$0**		
Excavator	$250 /hr	120	$30,000	0	$0		
Light Dozer	$150 /hr	180	$27,000	0	$0		
Front Loader	$100 /hr	180	$18,000	0	$0		
Light Trucks (3)	$100 /hr	360	$36,000	0	$0		
Backhoe	$100 /hr	50	$5,000	0	$0		
Backfill/Compact Wastes - On-Site Repository			**$17,000**				
Light Dozer	$150 /hr	60	$9,000	0	$0		
Front Loader	$100 /hr	50	$5,000	0	$0		
Compactor	$85 /hr	35	$3,000	0	$0		
Construct On-Site Impermeable Cap [4]			**$163,000**				
Grader	$250 /hr	80	$20,000				
Light Dozer	$150/hr	60	$9,000				
Backhoe	$100/hr	60	$6,000				
Compactor	$85 /hr	35	$3,000				
Install Membrane or GCL, including materials	lump sum		$45,000				
Import, Place Capillary Barrier Materials	lump sum		$80,000				
Excavate/Load Wastes for Off-Site Disposal					**$92,500**		
Excavator	$250 /hr	0	$0	100	$25,000		
Light Dozer	$150 /hr	0	$0	150	$22,500		
Front Loader	$100 /hr	0	$0	150	$15,000		
Backhoe	$100 /hr	0	$0	300	$30,000		
Transport Wastes - Off-Site Repository [3]					**$357,000**		

Item	Estimated Cost [1]	Alternative 1 On-Site Repository with Impermeable Cap		Alternative 2 Off-Site Repository		Alternative 3 No Action	
		Units	Cost	Units	Cost	Units	Cost
Large Trucks (15)	lump sum				$310,000		
Traffic Control, Taylor Park	lump sum				$47,000		
Road improvements, Taylor Park	lump sum	0					
Disposal Wastes - Off-Site Repository	per ton	0	$0		**$675,000**		
Reclaim/Regrade On-Site Repository	$100 /hr		**$12,000**				
Light Dozer	$150 /hr	24	$3,600	0	$0		
Front Loader	$100 /hr	19	$1,900	0	$0		
Grader	$250 /hr	26	$6,500	0	$0		
Backfill/Reclaim and Grade Excavated Areas			**$87,000**		**$87,000**		
Excavator	$250 /hr	60	$15,000	60	$15,000		
Front Loader	$100 /hr	120	$12,000	120	$12,000		
Light Dozer	$150 /hr	120	$18,000	120	$18,000		
Grader	$250 /hr	100	$25,000	100	$25,000		
Light Trucks (3)	$100 /hr	120	$12,000	120	$12,000		
Backhoe	$100 /hr	50	$5,000	50	$5,000		
Seeding and Mulching Disturbed Areas	lump sum		**$20,000**		**$20,000**		
REMOVAL ACTION CONSTRUCTION SUBTOTAL			**$686,500**		**$1,298,000**		
50 and 90% Removal Action Designs	lump sum		$45,000		$45,000		
Work Plan, Construction Quality Control Plan, Health and Safety Plan	lump sum		$12,000		$12,000		
Removal Action Oversight	lump sum		$15,000		$20,000		
Removal Action Report	lump sum		$7,500		$10,000		
TOTALS		**$766,000**		**$1,385,000**		**$0**	

Notes:
[1] Estimated costs based on maximum volume (approximately 10,000 cubic yards) waste for removal action
[2] Equipment and labor estimates based on Cost Estimating Guide for Road Construction, USDA Forest Service Northern Region Engineering, October 2017.

[3] Estimated transport costs assume disposal at the 6 Mile Lane Solid Waste Facility in Gunnison County, Colorado
[4] Estimated On-Site repository bottom floor surface area of approximately 35,000 square feet; 8 feet repository depth

Table 7-3: Removal Alternative Feasibility Comparison

Technology Class	Alternative	Description	Effectiveness (0-6)	Implementability (0-3)	Capital Cost (0-3)	O&M Cost (0-3)	Pros	Cons	Ranking	Preferred Alternative
Engineering Controls and Institutional Controls	On-site repository, stabilize and revegetate	Excavate repository on-Site, transport mine debris, tailings within and cap. stabilize and revegetate	High (6)	Moderate (2)	Moderate (2)	Moderate (2)	Minimizes human and ecological exposure moderate cost; complies with ARARs.	Waste is managed onsite.	**12**	**Yes**
Engineering Controls and Institutional Controls	Off-site disposal	Haul mine waste off- site to permitted landfill. Stabilize and revegetate LWA without removal of thin veneer.	High (6)	Low (1)	Low (1)	Moderate (2)	Very effective; removes risk of human and ecological exposure; complies with ARARs.	Higher cost requires finding acceptable repository location; traffic/hauling issues with public and recreational access. Liability concerns with waste off-Site.	**10**	**No**
No action	**No action**	Leave feature(s) as is.	Ineffective (0)	High (3)	High (3)	High (3)	Low cost, easily implemented.	No risk reduction, does not comply with ARARs/TBCs.	**9**	**No**

Table 8-1: 40 CFR 300.415(b) Factor Analysis

Factor	Site Condition	Satisfied?
1) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants, or contaminants.	The potential for human and ecological exposure to the former mill wastes and pond sediments will be significantly reduced following consolidation and capping/covering of these materials. In addition, physical hazards at the former mill site will be removed.	Yes
2) Actual or potential contamination of drinking water supplies or sensitive ecosystems.	There are no drinking wells or sensitive ecosystems on or near the Site. The metals and ABA results from the pond sediments and former mill sediments suggest that groundwater and off-site surface water are unlikely to be impaired by the proposed removal action.	Not applicable
3) Hazardous substances, pollutants, or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release.	There are no hazardous substances, pollutants, or contaminants in drums, barrels, tanks, or other bulk storage containers. The removal action does not need to address this factor.	Not applicable
4) High levels of hazardous substances, pollutants, or contaminants in soils largely at, or near, the surface that may migrate.	There does not appear to be a potential for migration of hazardous substances from the Site. However, the removal action will further minimize this potential.	Yes
5) Weather conditions that may cause hazardous substances, pollutants, or contaminants to migrate or be released.	The Site is located in a high alpine environment below major drainage features and could be subject to peak runoff events in Spring/Summer. However, the removal action will minimize potential for contaminant release.	Yes
6) Threat of fire or explosion.	There are no flammable materials on the Site. Potential exists for fire from lightning strikes in Summer. Post -removal Operations and Maintenance (O&M) would address erosion control and revegetation because of fire.	Satisfied
7) The availability of other appropriate federal or state response mechanisms to respond to the release.	The Site is on USFS-managed land and is being addressed by USFS.	Yes
8) Other situations or factors that may pose threats.	Physical hazards will be mitigated.	Yes

FIGURES

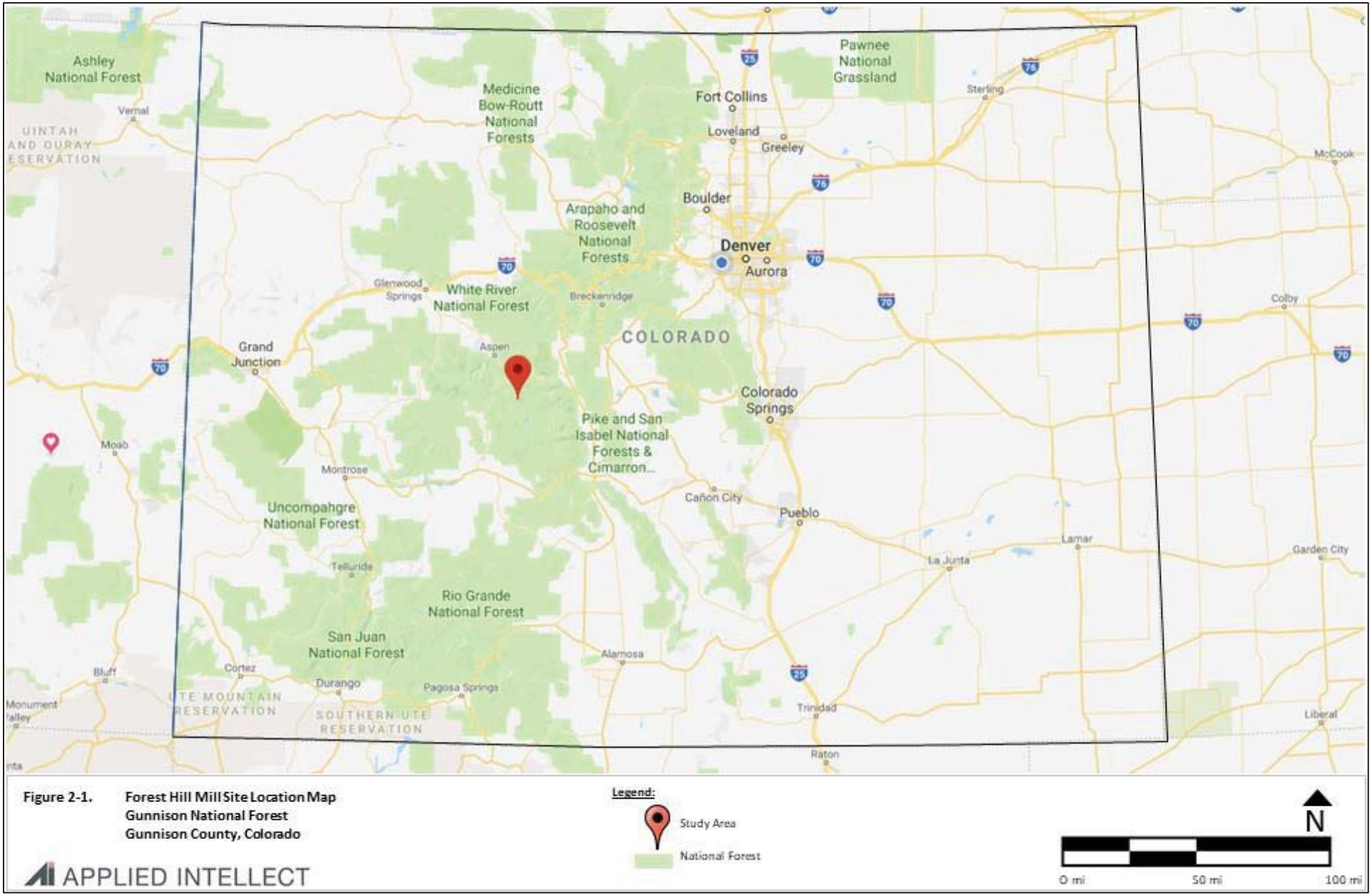

Figure 2-1. Forest Hill Mill Site Location Map
Gunnison National Forest
Gunnison County, Colorado

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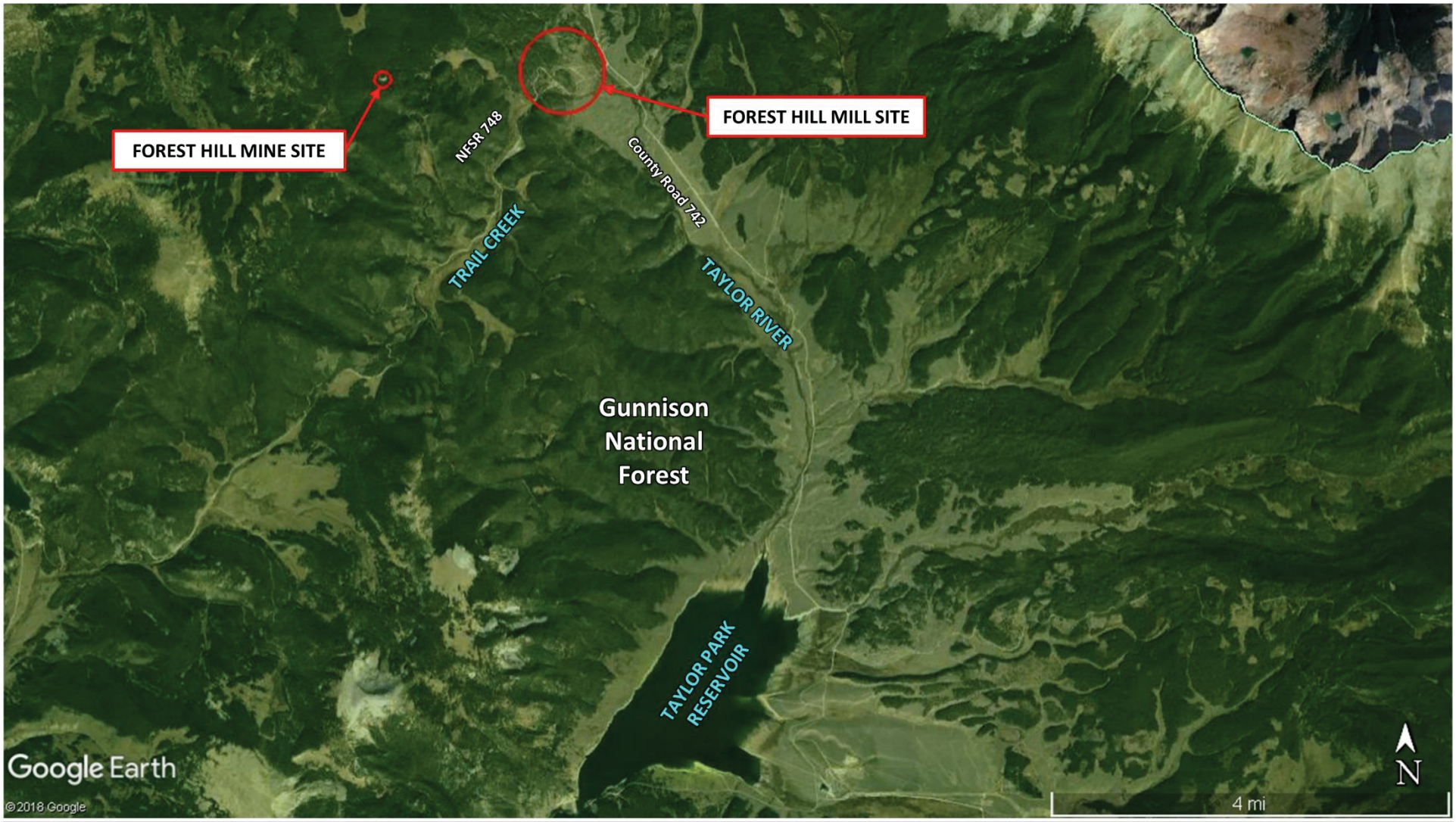

Figure 2-2. **Forest Hill Mill Site Vicinity Map**
Gunnison National Forest
Gunnison County, Colorado

Legend:
Study Area
Gunnison National Forest

APPLIED INTELLECT

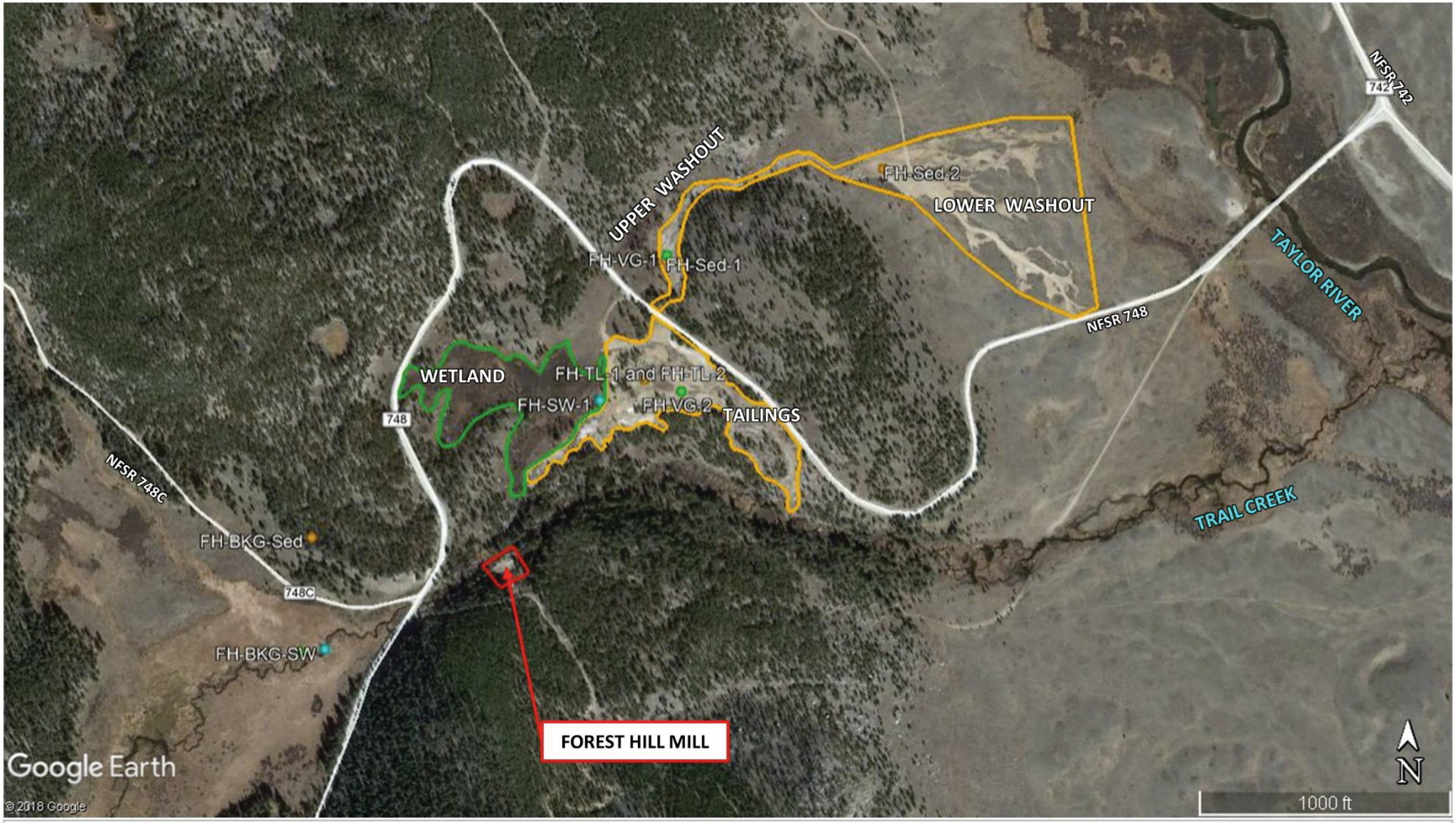

Figure 2-3. **Forest Hill Mill Site Layout**
Gunnison National Forest
Gunnison County, Colorado

Legend:

- Sediment/Tailings Sample
- Surface Water Sample
- Vegetation Sample
- Tailing/Washout Boundary
- Wetland Boundary
- Forest Hill Mill Location

Data Source: HRL, *Assessment Summary Report, Forest Hill Mill Site*, 2012

APPLIED INTELLECT

Figure 2-4. **Groundwater Wells Within 1 Mile of Forest Hill Mill and Tailings Study Area**
Gunnison National Forest
Gunnison County, Colorado

Legend:

- Former Mill Upper (FMU)
- Former Mill Lower (FML)
- Main Tailings Area 1 (MTA1)
- Main Tailings Area 2 (MTA2)
- Upper Washout Area 1 (UWA1)
- Upper Washout Area 2 (UWA2)
- Lower Washout Area 1 (LWA1)
- Lower Washout Area 2 (LWA2)
- Groundwater Well Buffer
- Colorado Department of Water Resources Water Well Applications

APPLIED INTELLECT

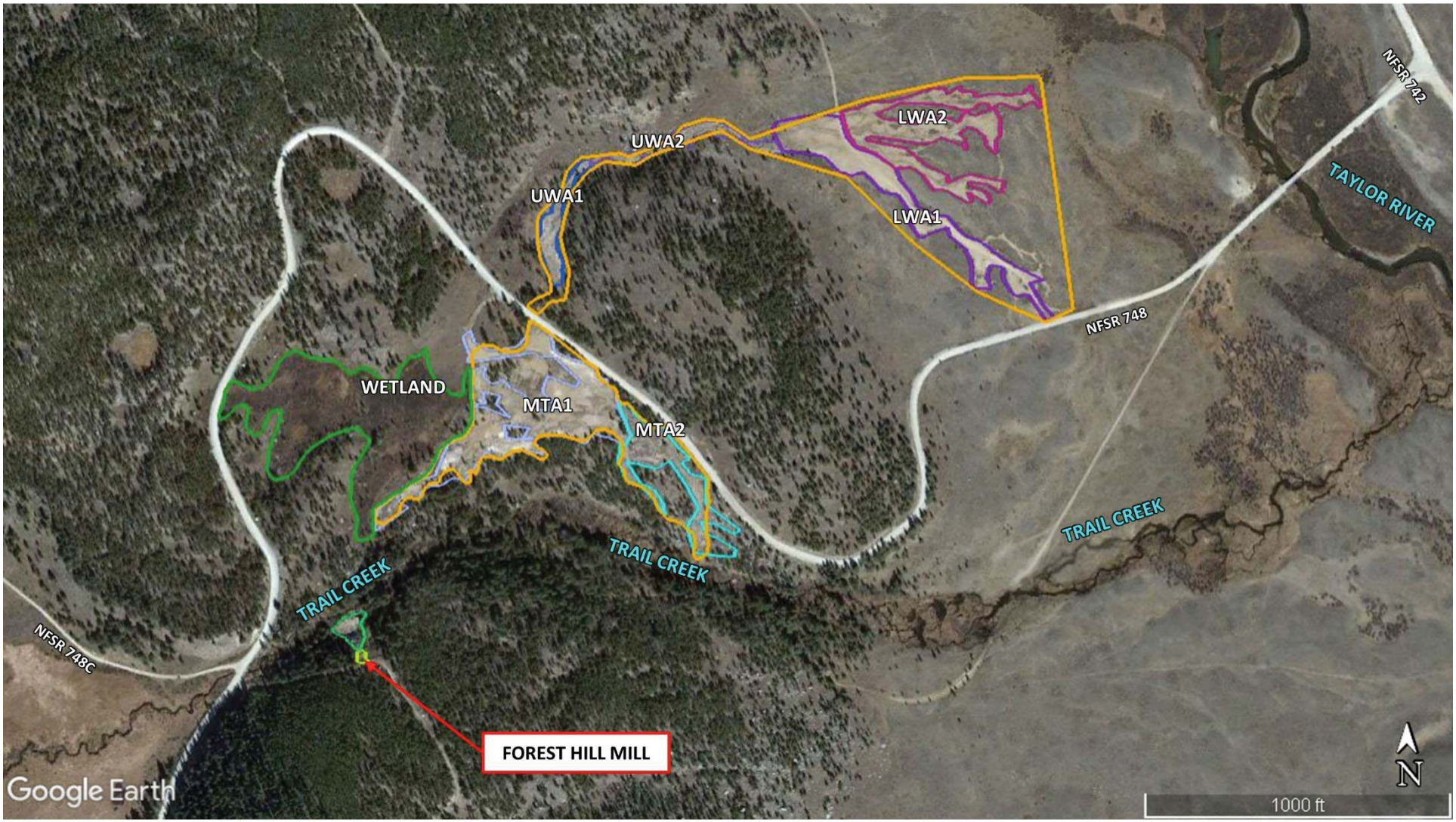

Figure 2-5. **Forest Hill Mill and Tailings Study Area Site Features**
Gunnison National Forest
Gunnison County, Colorado

Legend:

- Former Mill Upper (FMU)
- Former Mill Lower (FML)
- Main Tailings Area 1 (MTA1)
- Main Tailings Area 2 (MTA2)
- Wetland
- Upper Washout Area 1 (UWA1)
- Upper Washout Area 2 (UWA2)
- Lower Washout Area 1 (LWA1)
- Lower Washout Area 2 (LWA2)

APPLIED INTELLECT

Figure 2-6. **Forest Hill Mill Site Features**
Gunnison National Forest
Gunnison County, Colorado

Legend:
- Former Mill Upper (FMU)
- Former Mill Lower (FML)

APPLIED INTELLECT

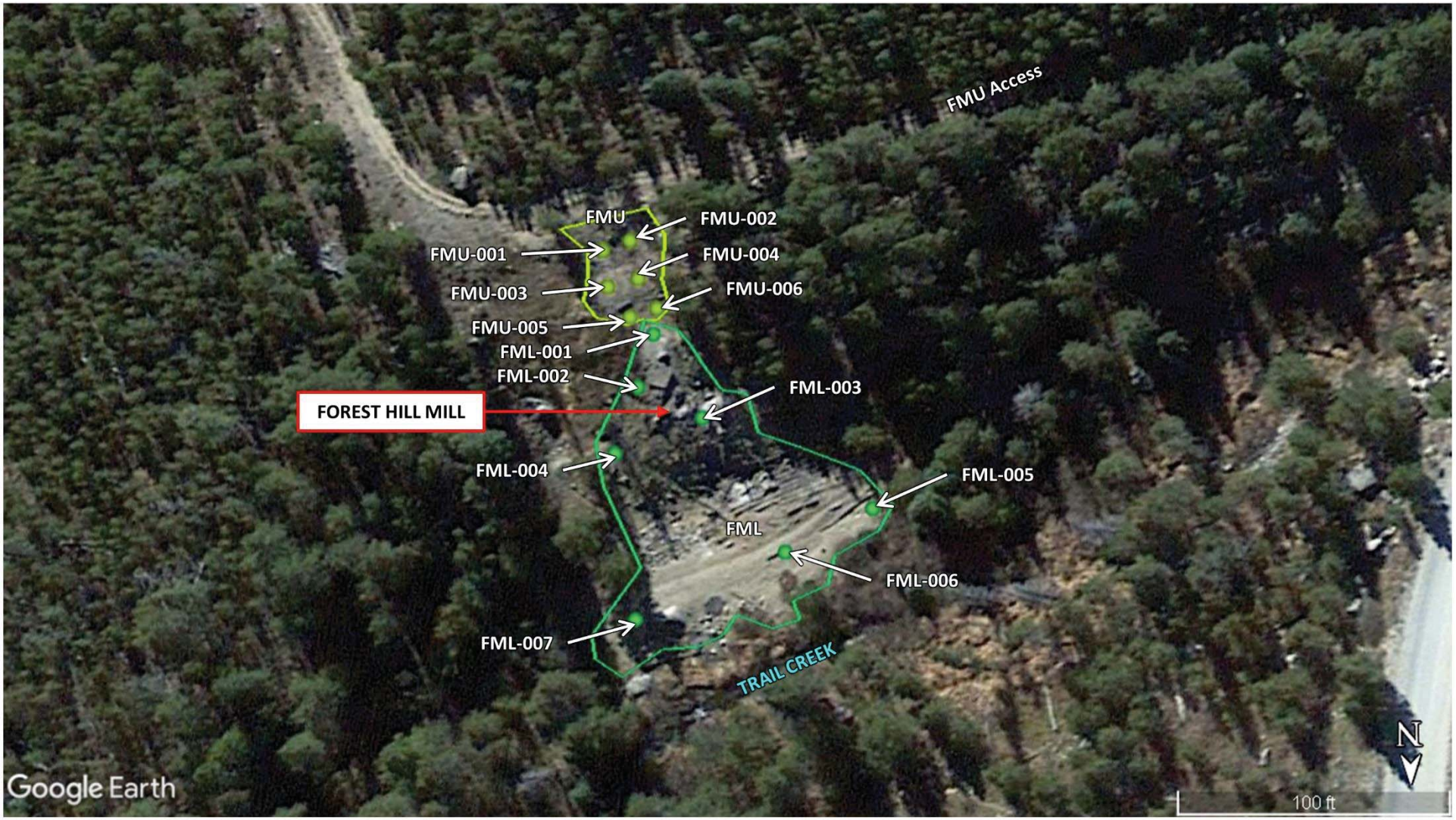

Figure 3-1. **Forest Hill Mill Site Sampling Locations**
October 8, 2018
Gunnison National Forest
Gunnison County, Colorado

Legend:
- Former Mill Upper (FMU)
- Former Mill Lower (FML)

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Figure 3-2. **Forest Hill Main Tailings Areas MTA1 and MTA2 Sampling Locations**
October 8, 2018
Gunnison National Forest
Gunnison County, Colorado

Legend:
Main Tailings Area 1 (MTA1)
Main Tailings Area 2 (MTA2)

APPLIED INTELLECT

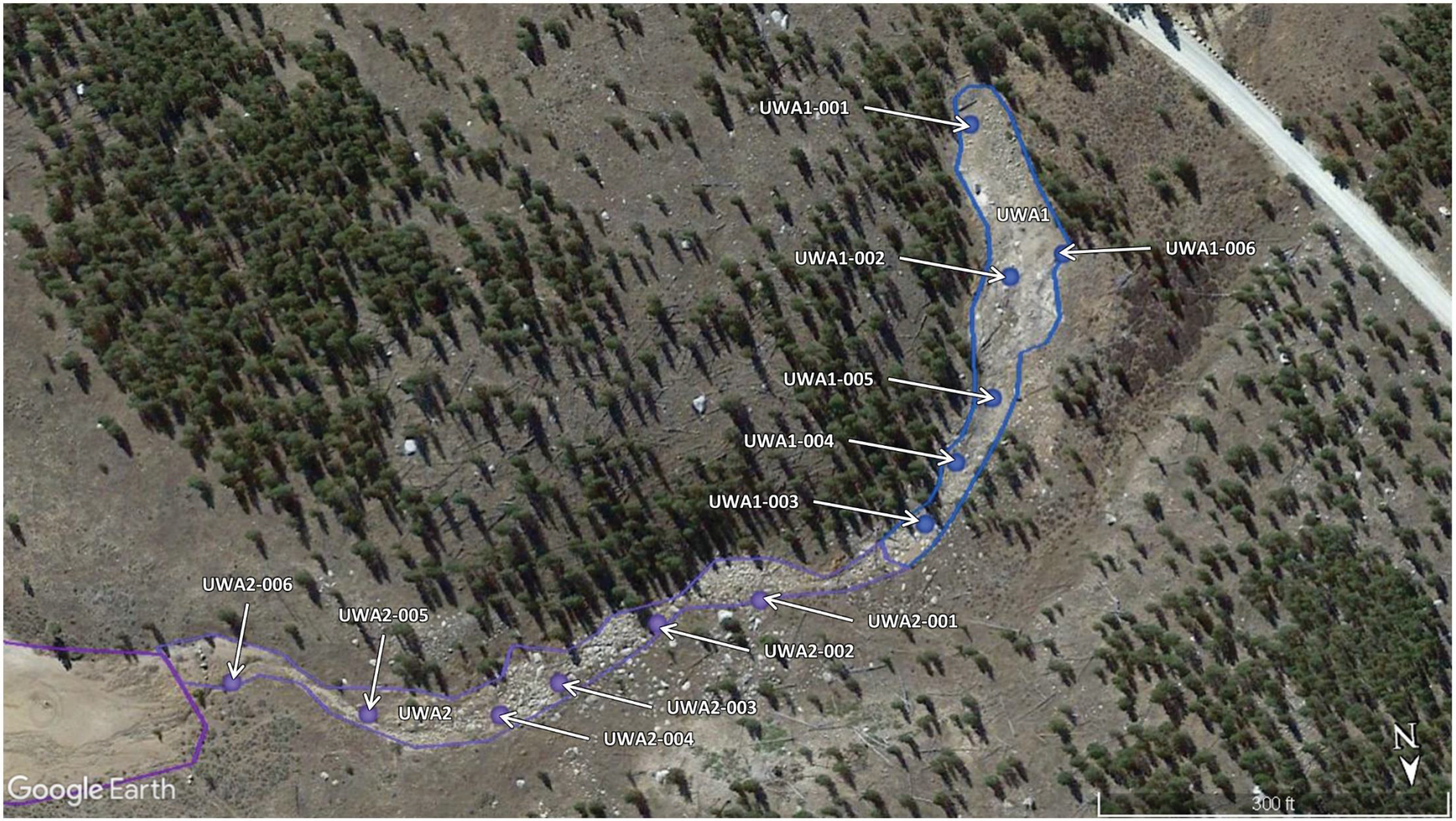


Figure 3-3. **Forest Hill Upper Washout Areas UWA1 and UWA2 Sampling Locations**
October 8, 2018
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT

Legend:
- Upper Washout Area 1 (UWA1)
- Upper Washout Area 2 (UWA2)
- Lower Washout Area 1 (LWA1)

Figure 3-4. **Forest Hill Lower Washout Areas LWA1 and LWA2 Sampling Locations**
October 8, 2018
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT

Legend:
- Upper Washout Area 2 (UWA2)
- Lower Washout Area 1 (LWA1)
- Lower Washout Area 2 (LWA2)

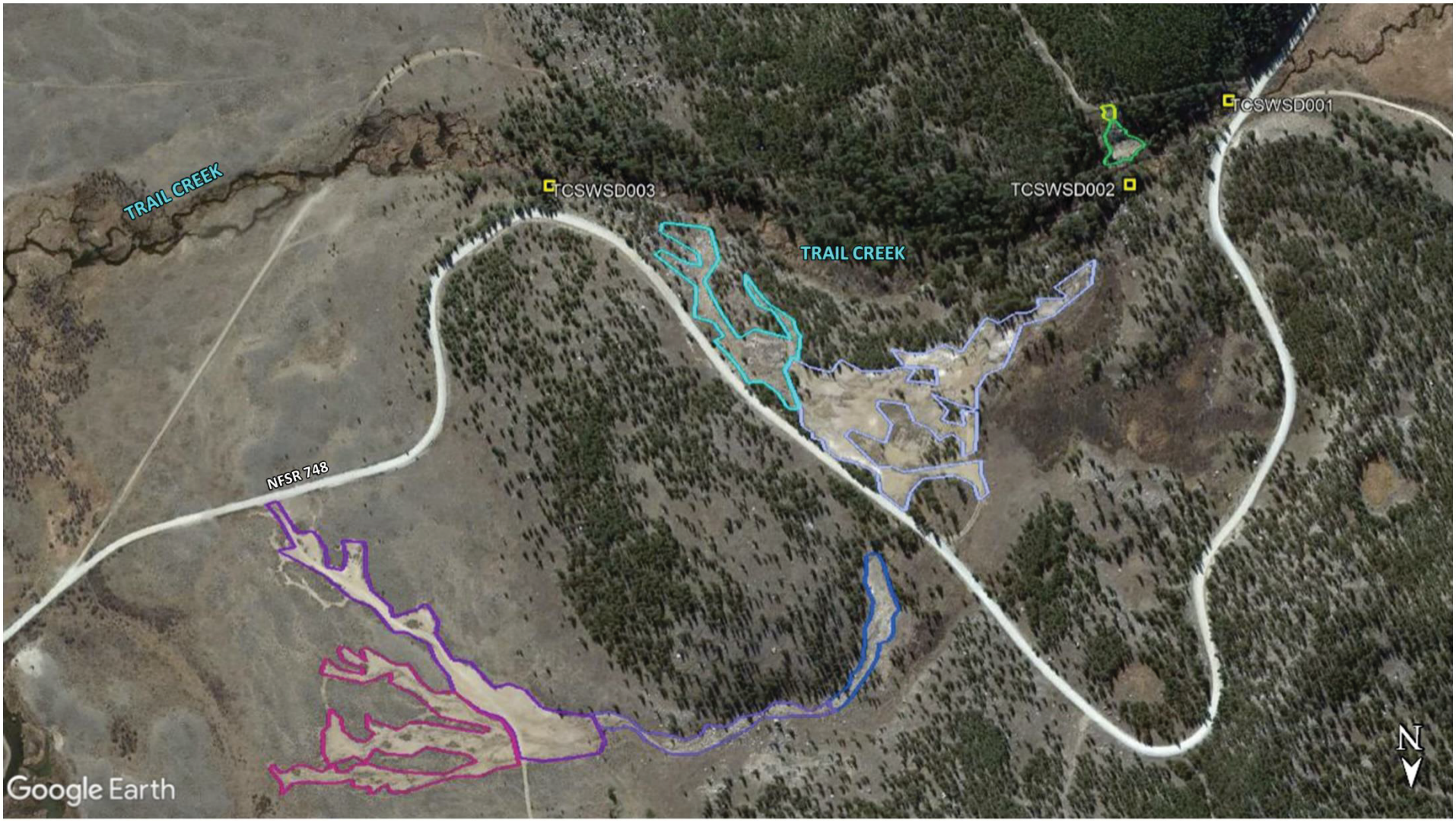


Figure 3-5. **Forest Hill Surface Water/Sediment Sampling Locations**
October 9, 2018
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT

Legend:

- Former Mill Upper (FMU)
- Former Mill Lower (FML)
- Main Tailings Area 1 (MTA1)
- Main Tailings Area 2 (MTA2)
- Wetland
- Upper Washout Area 1 (UWA1)
- Upper Washout Area 2 (UWA2)
- Lower Washout Area 1 (LWA1)
- Lower Washout Area 2 (LWA2)
- Surface Water/Sediment Sample

Figure 3-6. **Forest Hill Main Tailings Area Main Tailings Area 1 (MTA1) Pit Locations**
October 11, 2018
Gunnison National Forest
Gunnison County, Colorado

Legend:
Main Tailings Area 1 (MTA1)

APPLIED INTELLECT

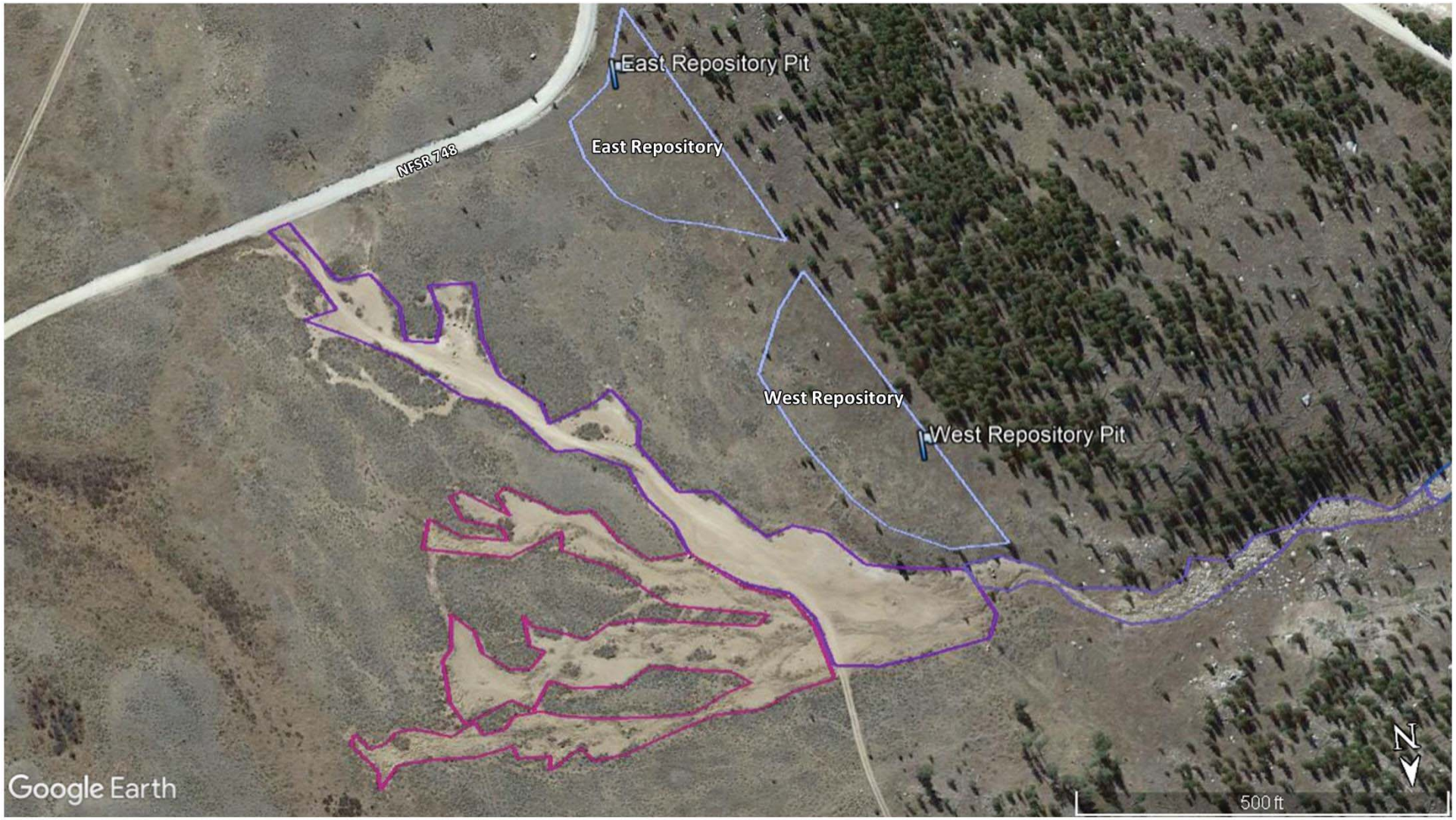
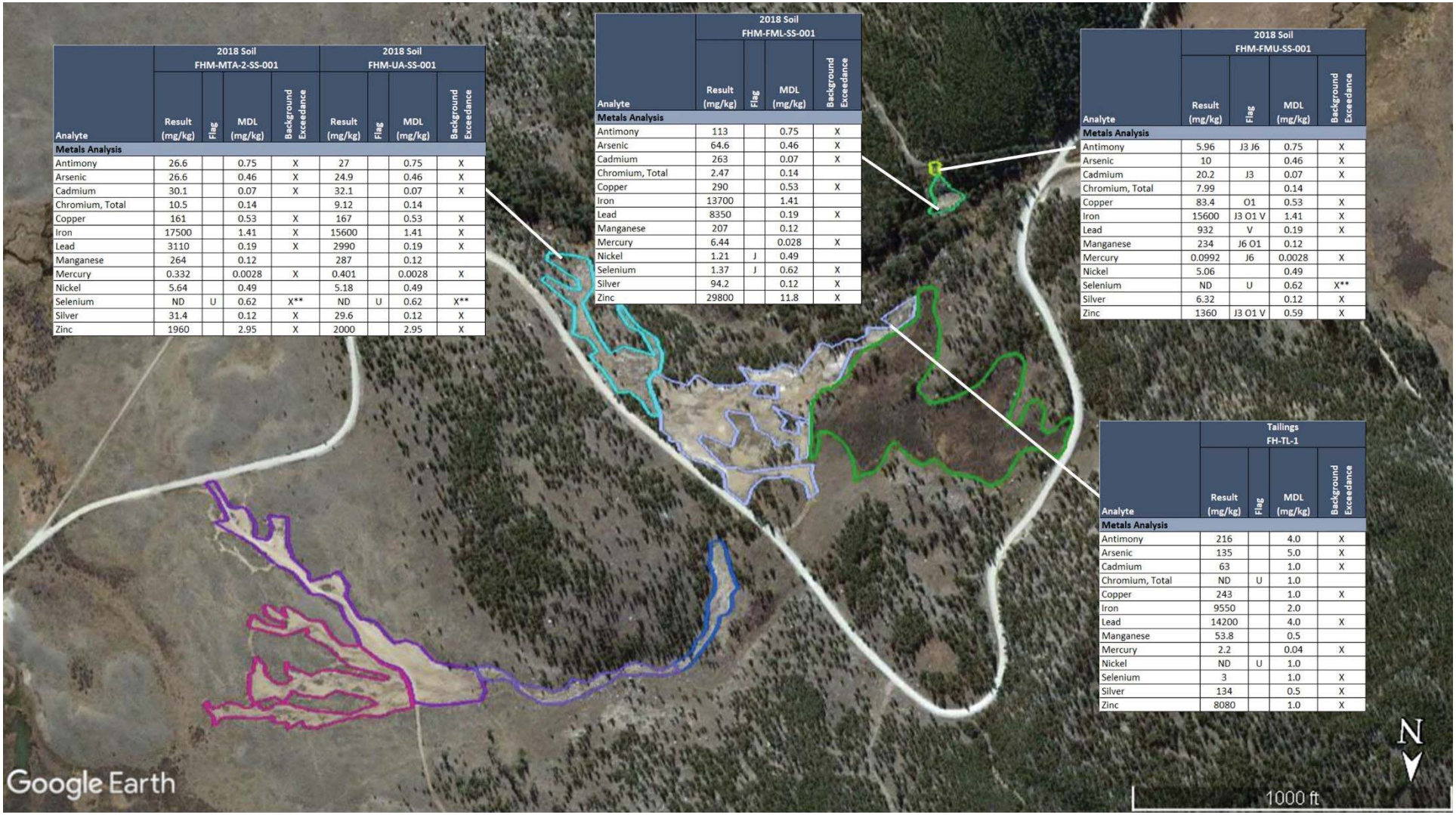


Figure 3-7. Forest Hill Potential Repositories and Pit Locations
October 11, 2018
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT



Analyte	2018 Soil FHM-MTA-2-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	2018 Soil FHM-UA-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis								
Antimony	26.6		0.75	X	27		0.75	X
Arsenic	26.6		0.46	X	24.9		0.46	X
Cadmium	30.1		0.07	X	32.1		0.07	X
Chromium, Total	10.5		0.14		9.12		0.14	
Copper	161		0.53	X	167		0.53	X
Iron	17500		1.41	X	15600		1.41	X
Lead	3110		0.19	X	2990		0.19	X
Manganese	264		0.12		287		0.12	
Mercury	0.332		0.0028	X	0.401		0.0028	X
Nickel	5.64		0.49		5.18		0.49	
Selenium	ND	U	0.62	X**	ND	U	0.62	X**
Silver	31.4		0.12	X	29.6		0.12	X
Zinc	1960		2.95	X	2000		2.95	X

Analyte	2018 Soil FHM-FML-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis				
Antimony	113		0.75	X
Arsenic	64.6		0.46	X
Cadmium	263		0.07	X
Chromium, Total	2.47		0.14	
Copper	290		0.53	X
Iron	13700		1.41	
Lead	8350		0.19	X
Manganese	207		0.12	
Mercury	6.44		0.028	X
Nickel	1.21	J	0.49	
Selenium	1.37	J	0.62	X
Silver	94.2		0.12	X
Zinc	29800		11.8	X

Analyte	2018 Soil FHM-FMU-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis				
Antimony	5.96	J3 J6	0.75	X
Arsenic	10		0.46	X
Cadmium	20.2	J3	0.07	X
Chromium, Total	7.99		0.14	
Copper	83.4	O1	0.53	X
Iron	15600	J3 O1 V	1.41	X
Lead	932	V	0.19	X
Manganese	234	J6 O1	0.12	
Mercury	0.0992	J6	0.0028	X
Nickel	5.06		0.49	
Selenium	ND	U	0.62	X**
Silver	6.32		0.12	X
Zinc	1360	J3 O1 V	0.59	X

Analyte	Tailings FH-TL-1 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis				
Antimony	216		4.0	X
Arsenic	135		5.0	X
Cadmium	63		1.0	X
Chromium, Total	ND	U	1.0	
Copper	243		1.0	X
Iron	9550		2.0	
Lead	14200		4.0	X
Manganese	53.8		0.5	
Mercury	2.2		0.04	X
Nickel	ND	U	1.0	
Selenium	3		1.0	X
Silver	134		0.5	X
Zinc	8080		1.0	X

Figure 3-8. **Forest Hill Mill Soil Sampling Results**
Mill and Main Tailings Area
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT

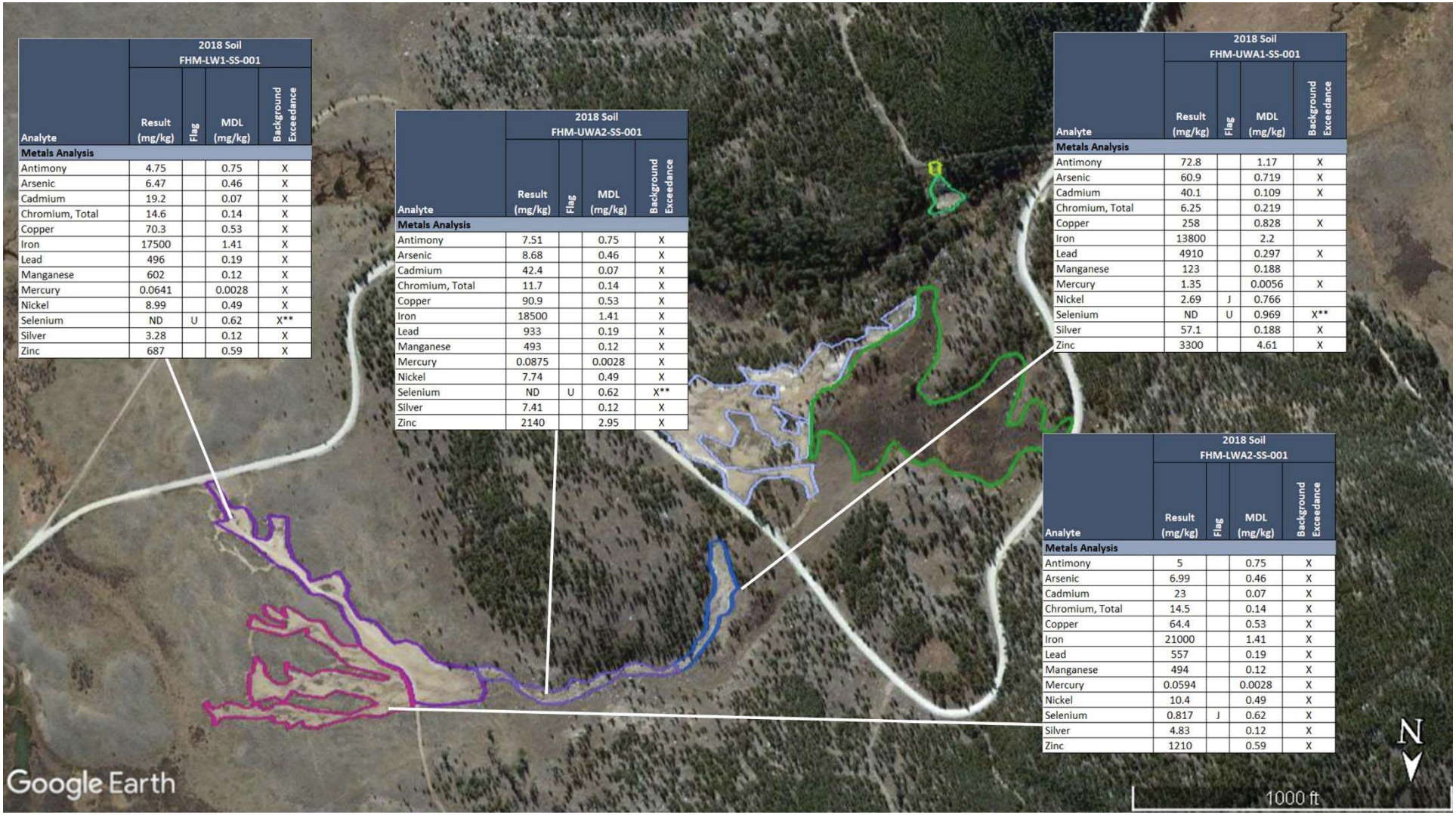
Legend:

- Former Mill Upper (FMU)
- Former Mill Lower (FML)
- Main Tailings Area 1 (MTA1)
- Main Tailings Area 2 (MTA2)
- Wetland
- Upper Washout Area 1 (UWA1)
- Upper Washout Area 2 (UWA2)
- Lower Washout Area 1 (LWA1)
- Lower Washout Area 2 (LWA2)

Notes:

MDL Method Detection Limit
mg/kg milligrams per liter
ND (U) Analyte not detected

See report for definition of flags.
FH-BKG SED (2010) used as background for comparison



Analyte	2018 Soil FHM-LW1-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis				
Antimony	4.75		0.75	X
Arsenic	6.47		0.46	X
Cadmium	19.2		0.07	X
Chromium, Total	14.6		0.14	X
Copper	70.3		0.53	X
Iron	17500		1.41	X
Lead	496		0.19	X
Manganese	602		0.12	X
Mercury	0.0641		0.0028	X
Nickel	8.99		0.49	X
Selenium	ND	U	0.62	X**
Silver	3.28		0.12	X
Zinc	687		0.59	X

Analyte	2018 Soil FHM-UWA2-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis				
Antimony	7.51		0.75	X
Arsenic	8.68		0.46	X
Cadmium	42.4		0.07	X
Chromium, Total	11.7		0.14	X
Copper	90.9		0.53	X
Iron	18500		1.41	X
Lead	933		0.19	X
Manganese	493		0.12	X
Mercury	0.0875		0.0028	X
Nickel	7.74		0.49	X
Selenium	ND	U	0.62	X**
Silver	7.41		0.12	X
Zinc	2140		2.95	X

Analyte	2018 Soil FHM-UWA1-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis				
Antimony	72.8		1.17	X
Arsenic	60.9		0.719	X
Cadmium	40.1		0.109	X
Chromium, Total	6.25		0.219	
Copper	258		0.828	X
Iron	13800		2.2	
Lead	4910		0.297	X
Manganese	123		0.188	
Mercury	1.35		0.0056	X
Nickel	2.69	J	0.766	
Selenium	ND	U	0.969	X**
Silver	57.1		0.188	X
Zinc	3300		4.61	X

Analyte	2018 Soil FHM-LWA2-SS-001 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis				
Antimony	5		0.75	X
Arsenic	6.99		0.46	X
Cadmium	23		0.07	X
Chromium, Total	14.5		0.14	X
Copper	64.4		0.53	X
Iron	21000		1.41	X
Lead	557		0.19	X
Manganese	494		0.12	X
Mercury	0.0594		0.0028	X
Nickel	10.4		0.49	X
Selenium	0.817	J	0.62	X
Silver	4.83		0.12	X
Zinc	1210		0.59	X

Figure 3-9. **Forest Hill Mill Soil Sampling Results**
Washout Area
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT

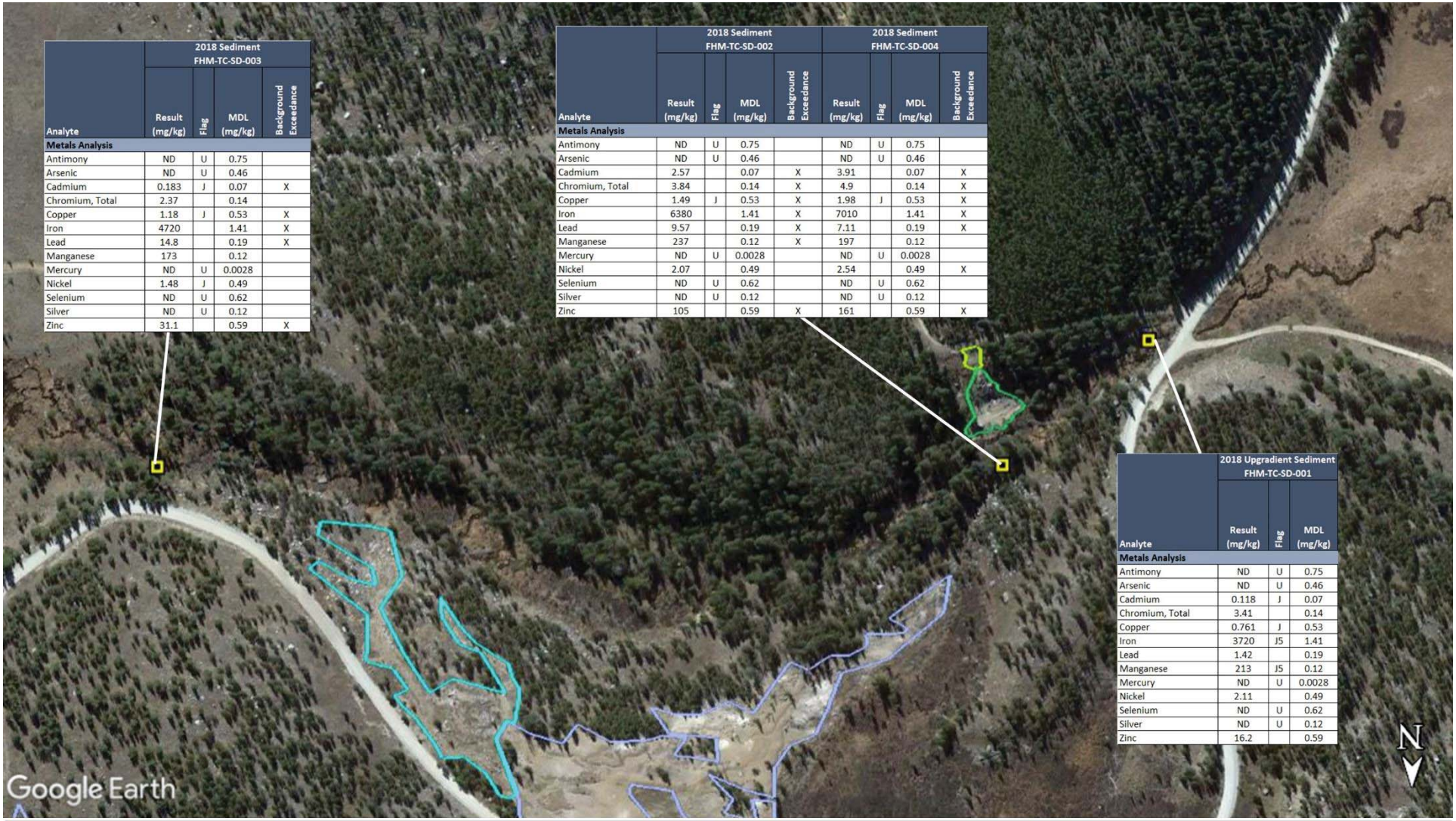
Legend:

- Former Mill Upper (FMU)
- Former Mill Lower (FML)
- Main Tailings Area 1 (MTA1)
- Main Tailings Area 2 (MTA2)
- Wetland
- Upper Washout Area 1 (UWA1)
- Upper Washout Area 2 (UWA2)
- Lower Washout Area 1 (LWA1)
- Lower Washout Area 2 (LWA2)

Notes:

MDL Method Detection Limit
mg/kg milligrams per liter
ND (U) Analyte not detected

See report for definition of flags.
FH-BKG SED (2010) used as background for comparison



Analyte	2018 Sediment FHM-TC-SD-003 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis				
Antimony	ND	U	0.75	
Arsenic	ND	U	0.46	
Cadmium	0.183	J	0.07	X
Chromium, Total	2.37		0.14	
Copper	1.18	J	0.53	X
Iron	4720		1.41	X
Lead	14.8		0.19	X
Manganese	173		0.12	
Mercury	ND	U	0.0028	
Nickel	1.48	J	0.49	
Selenium	ND	U	0.62	
Silver	ND	U	0.12	
Zinc	31.1		0.59	X

Analyte	2018 Sediment FHM-TC-SD-002 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance	2018 Sediment FHM-TC-SD-004 Result (mg/kg)	Flag	MDL (mg/kg)	Background Exceedance
Metals Analysis								
Antimony	ND	U	0.75		ND	U	0.75	
Arsenic	ND	U	0.46		ND	U	0.46	
Cadmium	2.57		0.07	X	3.91		0.07	X
Chromium, Total	3.84		0.14	X	4.9		0.14	X
Copper	1.49	J	0.53	X	1.98	J	0.53	X
Iron	6380		1.41	X	7010		1.41	X
Lead	9.57		0.19	X	7.11		0.19	X
Manganese	237		0.12	X	197		0.12	
Mercury	ND	U	0.0028		ND	U	0.0028	
Nickel	2.07		0.49		2.54		0.49	X
Selenium	ND	U	0.62		ND	U	0.62	
Silver	ND	U	0.12		ND	U	0.12	
Zinc	105		0.59	X	161		0.59	X

Analyte	2018 Upgradient Sediment FHM-TC-SD-001 Result (mg/kg)	Flag	MDL (mg/kg)
Metals Analysis			
Antimony	ND	U	0.75
Arsenic	ND	U	0.46
Cadmium	0.118	J	0.07
Chromium, Total	3.41		0.14
Copper	0.761	J	0.53
Iron	3720	J5	1.41
Lead	1.42		0.19
Manganese	213	J5	0.12
Mercury	ND	U	0.0028
Nickel	2.11		0.49
Selenium	ND	U	0.62
Silver	ND	U	0.12
Zinc	16.2		0.59

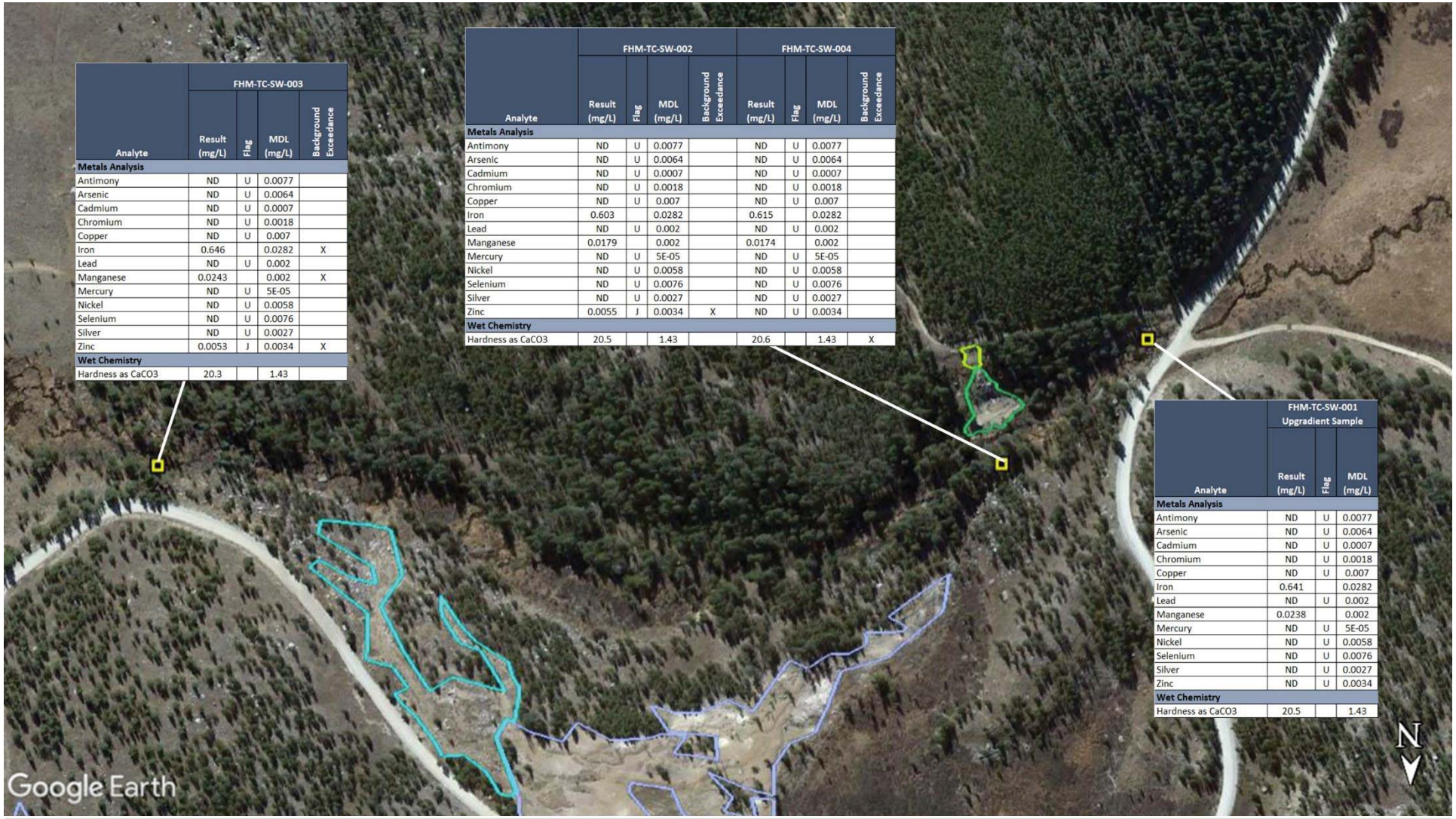
Figure 3-10. Forest Hill Mill Sediment Sampling Results
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT

Legend:
- Former Mill Upper (FMU)
- Former Mill Lower (FML)
- Main Tailings Area 1 (MTA1)
- Main Tailings Area 2 (MTA2)
- Surface Water/Sediment Sample Location

Notes:
- MDL — Method Detection Limit
- mg/kg — milligrams per liter
- ND (U) — Analyte not detected

See report for definition of flags.
FHM-TC-SD-001 (2018) used as background for comparison



Analyte	FHM-TC-SW-003 Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance
Metals Analysis				
Antimony	ND	U	0.0077	
Arsenic	ND	U	0.0064	
Cadmium	ND	U	0.0007	
Chromium	ND	U	0.0018	
Copper	ND	U	0.007	
Iron	0.646		0.0282	X
Lead	ND	U	0.002	
Manganese	0.0243		0.002	X
Mercury	ND	U	5E-05	
Nickel	ND	U	0.0058	
Selenium	ND	U	0.0076	
Silver	ND	U	0.0027	
Zinc	0.0053	J	0.0034	X
Wet Chemistry				
Hardness as CaCO3	20.3		1.43	

Analyte	FHM-TC-SW-002 Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance	FHM-TC-SW-004 Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance
Metals Analysis								
Antimony	ND	U	0.0077		ND	U	0.0077	
Arsenic	ND	U	0.0064		ND	U	0.0064	
Cadmium	ND	U	0.0007		ND	U	0.0007	
Chromium	ND	U	0.0018		ND	U	0.0018	
Copper	ND	U	0.007		ND	U	0.007	
Iron	0.603		0.0282		0.615		0.0282	
Lead	ND	U	0.002		ND	U	0.002	
Manganese	0.0179		0.002		0.0174		0.002	
Mercury	ND	U	5E-05		ND	U	5E-05	
Nickel	ND	U	0.0058		ND	U	0.0058	
Selenium	ND	U	0.0076		ND	U	0.0076	
Silver	ND	U	0.0027		ND	U	0.0027	
Zinc	0.0055	J	0.0034	X	ND	U	0.0034	
Wet Chemistry								
Hardness as CaCO3	20.5		1.43		20.6		1.43	X

Analyte	FHM-TC-SW-001 Upgradient Sample Result (mg/L)	Flag	MDL (mg/L)
Metals Analysis			
Antimony	ND	U	0.0077
Arsenic	ND	U	0.0064
Cadmium	ND	U	0.0007
Chromium	ND	U	0.0018
Copper	ND	U	0.007
Iron	0.641		0.0282
Lead	ND	U	0.002
Manganese	0.0238		0.002
Mercury	ND	U	5E-05
Nickel	ND	U	0.0058
Selenium	ND	U	0.0076
Silver	ND	U	0.0027
Zinc	ND	U	0.0034
Wet Chemistry			
Hardness as CaCO3	20.5		1.43

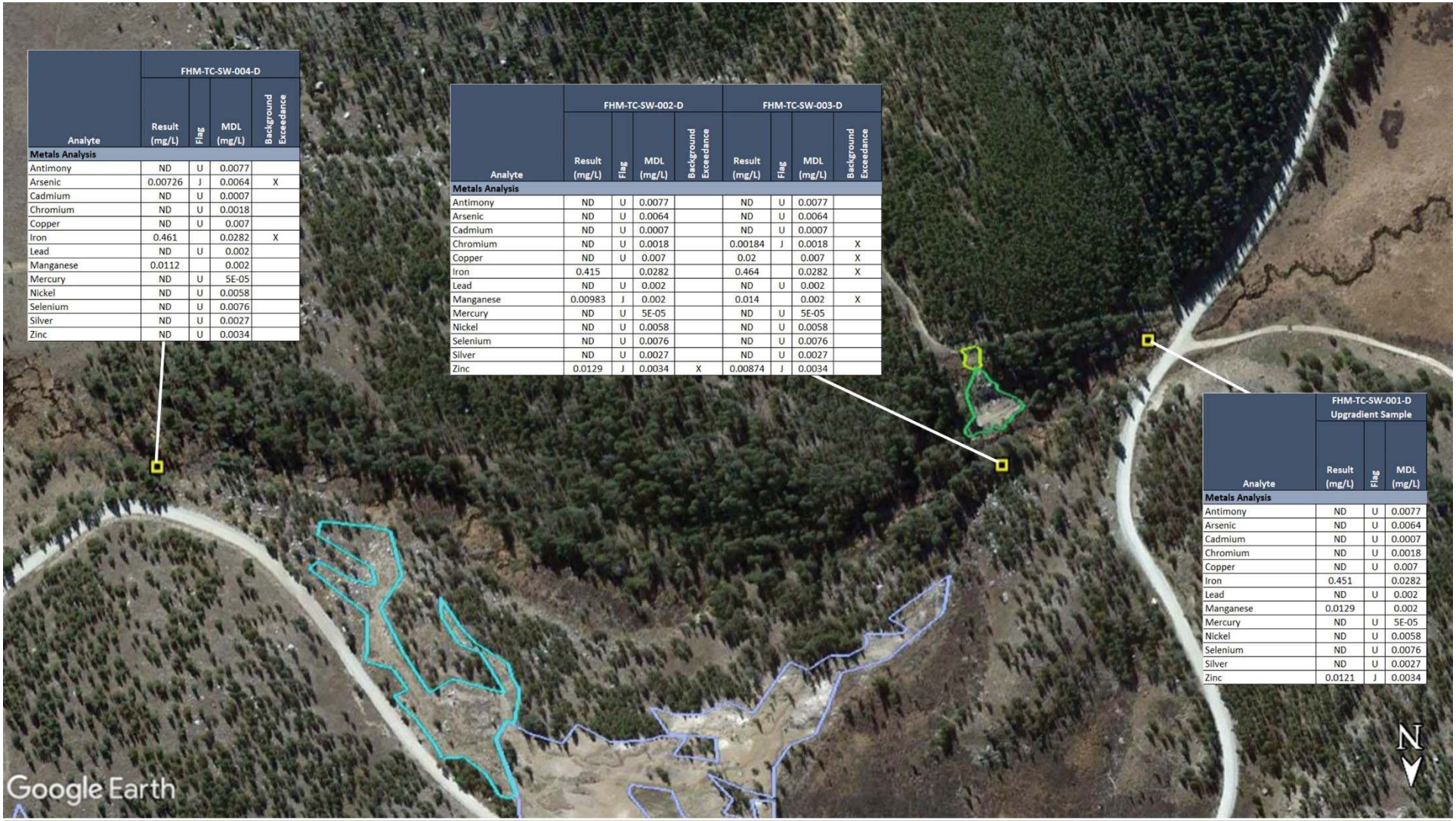
Figure 3-11. Forest Hill Mill Surface Water Sampling Results
Total
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT

Legend:
- Former Mill Upper (FMU)
- Former Mill Lower (FML)
- Main Tailings Area 1 (MTA1)
- Main Tailings Area 2 (MTA2)
- Surface Water/Sediment Sample Location

Notes:
- MDL — Method Detection Limit
- mg/L — milligrams per liter
- ND (U) — Analyte not detected

See report for definition of flags.
FHM-TC-SW-001 (2018) used as background for comparison



Analyte	FHM-TC-SW-004-D Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance
Metals Analysis				
Antimony	ND	U	0.0077	
Arsenic	0.00726	J	0.0064	X
Cadmium	ND	U	0.0007	
Chromium	ND	U	0.0018	
Copper	ND	U	0.007	
Iron	0.461		0.0282	X
Lead	ND	U	0.002	
Manganese	0.0112		0.002	
Mercury	ND	U	5E-05	
Nickel	ND	U	0.0058	
Selenium	ND	U	0.0076	
Silver	ND	U	0.0027	
Zinc	ND	U	0.0034	

Analyte	FHM-TC-SW-002-D Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance	FHM-TC-SW-003-D Result (mg/L)	Flag	MDL (mg/L)	Background Exceedance
Metals Analysis								
Antimony	ND	U	0.0077		ND	U	0.0077	
Arsenic	ND	U	0.0064		ND	U	0.0064	
Cadmium	ND	U	0.0007		ND	U	0.0007	
Chromium	ND	U	0.0018		0.00184	J	0.0018	X
Copper	ND	U	0.007		0.02		0.007	X
Iron	0.415		0.0282		0.464		0.0282	X
Lead	ND	U	0.002		ND	U	0.002	
Manganese	0.00983	J	0.002		0.014		0.002	X
Mercury	ND	U	5E-05		ND	U	5E-05	
Nickel	ND	U	0.0058		ND	U	0.0058	
Selenium	ND	U	0.0076		ND	U	0.0076	
Silver	ND	U	0.0027		ND	U	0.0027	
Zinc	0.0129	J	0.0034	X	0.00874	J	0.0034	

Analyte	FHM-TC-SW-001-D Upgradient Sample Result (mg/L)	Flag	MDL (mg/L)
Metals Analysis			
Antimony	ND	U	0.0077
Arsenic	ND	U	0.0064
Cadmium	ND	U	0.0007
Chromium	ND	U	0.0018
Copper	ND	U	0.007
Iron	0.451		0.0282
Lead	ND	U	0.002
Manganese	0.0129		0.002
Mercury	ND	U	5E-05
Nickel	ND	U	0.0058
Selenium	ND	U	0.0076
Silver	ND	U	0.0027
Zinc	0.0121	J	0.0034

Figure 3-12. Forest Hill Mill Surface Water Sampling Results
Dissolved
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT

Legend:
- Former Mill Upper (FMU)
- Former Mill Lower (FML)
- Main Tailings Area 1 (MTA1)
- Main Tailings Area 2 (MTA2)
- Surface Water/Sediment Sample Location

Notes:
MDL Method Detection Limit
mg/L milligrams per liter
ND Analyte not detected

See report for definition of flags.
FHM-TC-SW-001-D (2018) used as background for comparison

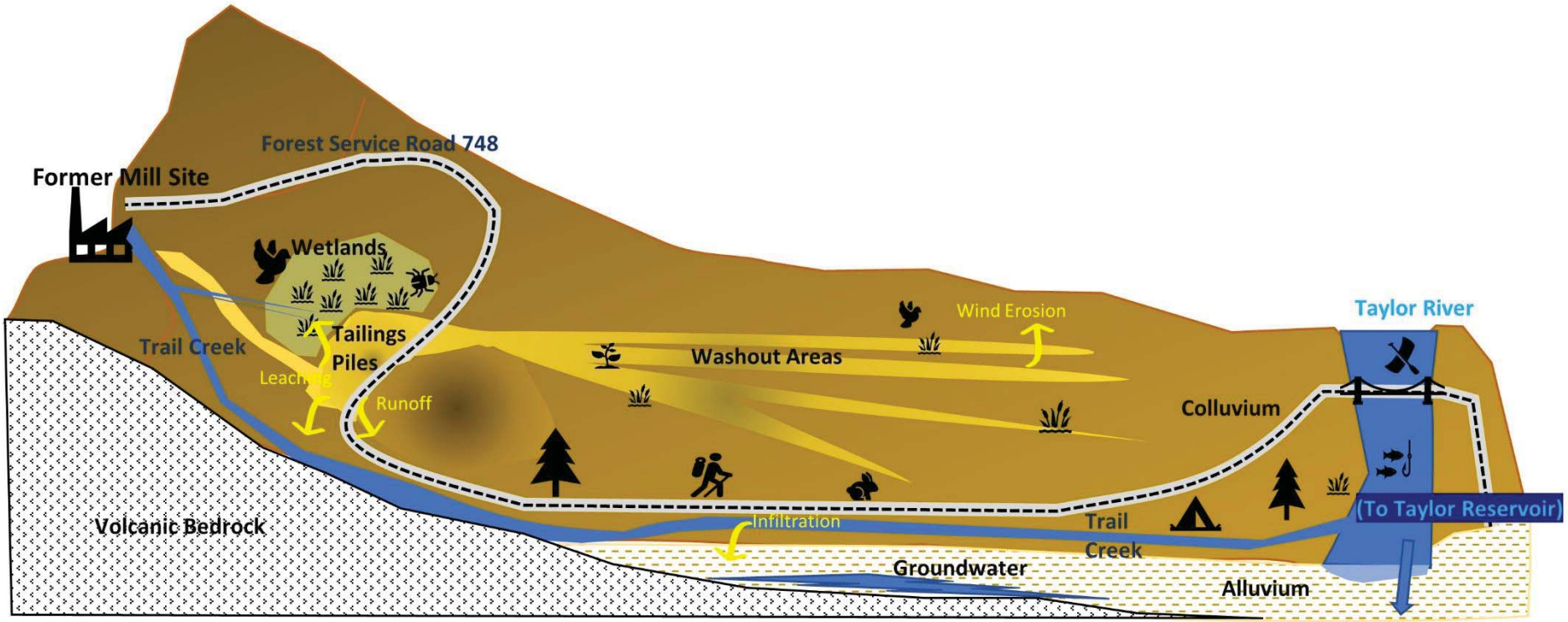
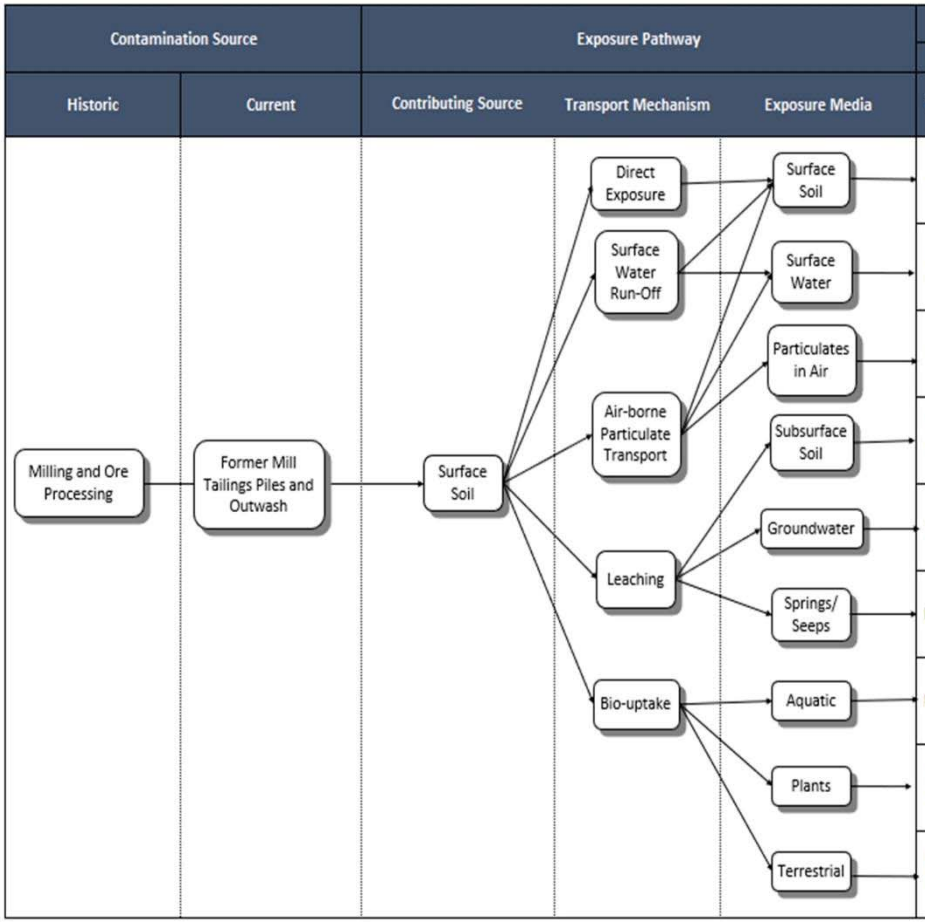


Figure 5-1. **Conceptual Site Model**
Forest Hill Mill and Tailings Outwash
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT



Contamination Source		Exposure Pathway			Human Receptor			Ecological Receptors			Explanation
					Current Use	Future Land Use					
Historic	Current	Contributing Source	Transport Mechanism	Exposure Media	Recreatonist/ Camper	Industrial or Const. Worker	Resident	Birds and Mammals	Plants and Invertebrates	Aquatic Biota	
			Direct Exposure	Surface Soil	Complete	Potentially Complete	Potentially Complete	Complete	Complete	Incomplete	Direct contact to surface soil is complete for Campers and terrestrial ecological receptors.
			Surface Water Run-Off	Surface Water	Potentially Complete	Incomplete	Incomplete	Insignificant	Insignificant	Complete	Ingestion or dermal contact to surface water is complete for campers, terrestrial and aquatic ecological receptors
			Air-borne Particulate Transport	Particulates in Air	Complete	Potentially Complete	Potentially Complete	Complete	Complete	Incomplete	Inhalation of dust particulates is complete for campers and terrestrial ecological receptors. Tailings and Mill Area are not well-vegetated.
Milling and Ore Processing	Former Mill Tailings Piles and Outwash	Surface Soil		Subsurface Soil	Potentially Complete	Potentially Complete	Potentially Complete	Complete	Complete	Incomplete	Direct Contact to subsurface soil is complete for burrowing animal, plants with deep roots and burrowing invertebrates.
			Leaching	Groundwater	Incomplete	Potentially Complete	Potentially Complete	Incomplete	Incomplete	Incomplete	Groundwater may be complete if futeure well are installed in the study area.
				Springs/ Seeps	Insignificant	Insignificant	Insignificant	Potentially Complete	Potentially Complete	Incomplete	Seeps and springs associated with adjacent wetlands that are habitat for ecological receptors.
			Bio-uptake	Aquatic	Insignificant	Incomplete	Incomplete	Potentially Complete	Incomplete	Complete	Surface water concentrations of metals were very low during fal sampling event in Ocober 2018.
				Plants	Potentially Complete	Incomplete	Incomplete	Potentially Complete	Potentially Complete	Potentially Complete	Adjacent wetlands are habitat for terrestrial ecological receptors.
				Terrestrial	Potentially Complete	Incomplete	Incomplete	Potentially Complete	Insignificant	Incomplete	Hunting and carrion ingetion of terrestrial animals is possible but likely indignificant adverse effect.

Figure 5-2. Conceptual Site Exposure Model
Forest Hill Mill and Tailings Outwash
Gunnison National Forest
Gunnison County, Colorado

APPLIED INTELLECT

Appendix A

Field Notes, October 8 through 11, 2018
Forest Hill EE/CA Field Investigation
Applied Intellect, LLC

MONDAY OCT 8, 2018

0845. JEFF HART (JH) AND JOHN DEANGELIS (JD) AT FOREST HILL MILL EELCA SITE TO BEGIN 3DAY SAMPLING EVENT.

WEATHER 30°, SUNNY to OVERCAST SOME SNOW ON PEAKS.

-STARTING AT MILL SITE WHILE WEATHER IS GOOD, PARK ON AT BACKGROUND WATER LOCATION AT INTERSECTION.

GETTING ORGANIZED

0850: HEALTH AND SAFETY BRIEFING

0900: AT UPPER MILL (UM) AREA FROM ACCESS ROAD WHICH IS NARROW AND BOULDER STREWN to LIMIT ACCESS

0920. JH LAID OUT SIX SUBSAMPLES FOR THE UFM AREA - APPEARS TO BE NATURAL MATERIAL (GRANITE COBBLES AND GRAVEL)

OBVIOUS TAILINGS (YELLOW COLORED to the SOUTH) IS NOT SAMPLED

0925-, 2 8oz JARS PER SUB SAMPLE COMPOSITED IN A CLEAN BUCKET

0930: MS/MSD will be Collected at UM AREA FROM 6 SUBS, 0-6 inches

1005: SAMPLE COMPOSITED IN BAG (FMU)
GPS Coordinates Collected (FMU 0-6)
Moving to Former Mill Pond (FML)

11.02: Completed Sampling, GPS FML (see fig)

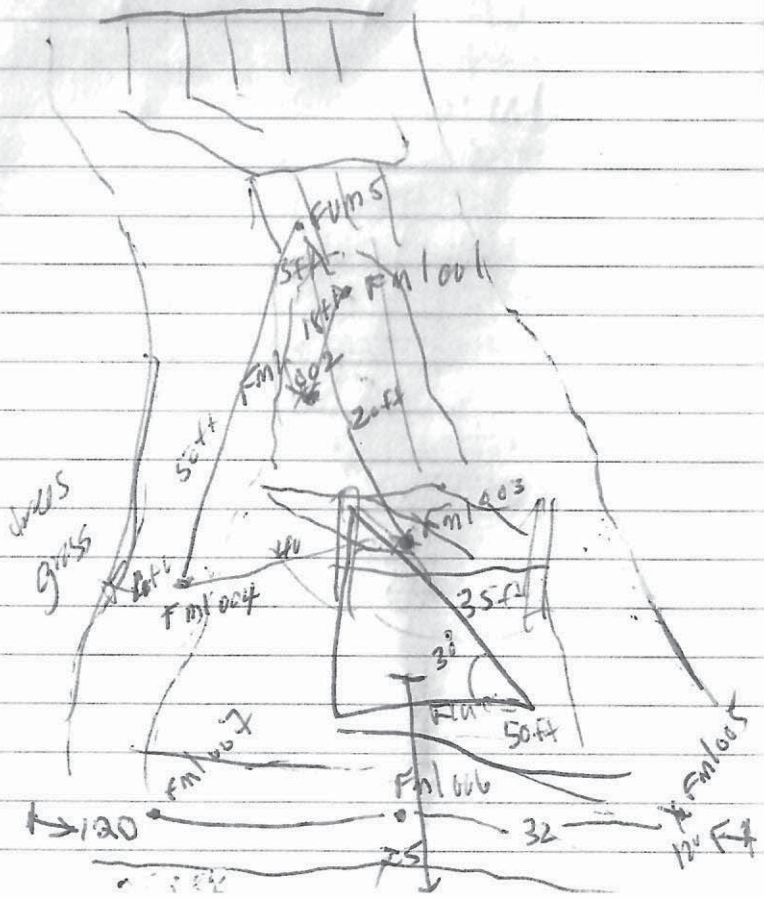


TABLE of GPS coordinates

	fig 1	2	3	4	5	6	7	8
UM	1	2	3					

1205: SAN MALE Moose AT MTA1 AT UWA001 w.2a walk DownRiver UWA001 is rocky, mostly Not healing but No growth

1215 UWA002 Approx 5ft South in obvious yellow tailings. ONLY 3-inch thick above dark brown loam, (insitu). Grab Sample/ dig 3-inches Approx 90ft wide (main area)

1220 UWA003 in washout, similar 2-3 inch thick over brown topsoil, only yellow tailings sampled Approx 100yd N of 002

1228: Breaking UWA into UWA1 to UWA2, UWA2 is North with Vegetation in Washout, UWA1 is S (chips) but not Vegetated - UWA is Stripper, mud bottles, IV: Ring Actuator, excavated.

1240: UWA1004 - approx 75ft S of UWA003 going back South from lower edge of UWA1 40-50ft wide Unvegetated, impacted.

1245: UWA1-005, 40-50 wide Unvegetated

1250: UWA1-006, West of UWA002 tailings approx 5-inches thick approx 90 ft wide

1303: UWA2001, Area is Vegetated, looks barely impacted

1310: Took upper and point 23-27 to Average waypoints For South of UWA2, N UWA1

1312: UWA2-002, Vegetated DK Brown Soil with rocks

1320: UWA2003 N of 002 ~ 15ft SAME, NOT IMPACTED

1325: UWA2004/5 Almost 2nd Gen LUWA1, Brown, Rocks, grassy

1330: UWA2006, adj to UWA2

1333: UWA2004, Back Between 005-003 GPSd,

1340: SNOW STORM, IN Vehicles eating lunch

1407: Setting up to Sample MTA2

1425: MTA2-001, Westward in Compost At edge of trees

1427 4inch thick, brown soil below

1427 MTA2-002 Boyd E.

1431 MTA2-003 40 Yd E

MTA2-003, 1.5 inch gray / 1.5 inch dk brown bottom 3 in Red brown Natural

1433: MTA2-004 ON BANK ABOVE TRAIL CK Appx 4 in Fine brown no vegetation

1442: MTA2-005 ~16 ft E IN Trees

1450: MTA2-006, NE END Grass Growing, coarse Sand (FV=1

1610: COMPLETED SAMPLING MTA1-001-008 AT LOWER WASHOUT AREA (LWA) WEATHER SLEET/SNOW, GROUND Wet. T. = 29°F

1624: LWA1-001 AT SW Corner of LWA1 SW PARKING Lot

1628: LWA1-002 10 ft N of 002, Reddish Brown

1635: 100ft E of 002 middle of parking area. LWA1-003

1640: 206ft E of 003, ALONG S of road. LWA1-004

1643: 150 FT E in open Area S of ACCESS ROAD LWA1-005

1648: IN TURNOUT S OF ACCESS ROAD closest to MAIN ROAD —

LWA1-006 - REDDISH BROWN Sand and Silt Some Clay

1130: JH AND JD COMPLETE SOIL SAMPLING AND OFFSITE WITH SAMPLES.

MAIN OUT 8, 2018

Weather overcast cold ≈ 20 F
NO Wind

OCT 9 2018

0740: call 605 ~~4~~5 431 5432 } Road H. Mainline

CALLED [illegible] HANSEN, MAINLINE Contracting
- WORK IS PROCEEDING IN NOW
- FRONT END LOADER IS GETTING UP ROAD FOR BEDDING MATERIAL
- IF NOT ML WILL FILL A DUMP TRUCK AND DRIVE THRU BACK GATE

0816: AT LWA2, JD ONSITE COLLECTING SAMPLES. JH TO GPS (AVERAGE) locations

0818: LWA2-001 DARK reddish Brown SANDY SILT W/GRAVEL, cobble
NO obvious TAILINGS STRATA IN 6-INCH SAMPLE Hole

0825: LWA2-002 150 FT E OF 001 N OF ACCESS Rd.
SAME LITHOLOGY AS 001

0830: LWA2-003, 90 FT E OF 002 N OF ACCESS ROAD, WITH SAME

0837: LWA2-004, 190 FT E OF 003 APPROX 50 N OF ACCESS ROAD ~ 150 YD W OF MAIN [illegible] TO MILL

16[illegible] [illegible]2-005, 230 FT N of 004

1643 [illegible] yd from Main Road to Mill

0852: LWA2-006 ~ 200 FT SW, toward 001 Reddish Brown Silt and Sand, Some Cobble Surface is more fine material, as is [illegible] N, differentiated Strata at 6 inch

0858: LWA2-007 ~ 100 ft SW 006, toward 001 similar to 006 Lithology

0906: FINISHED SAMPLING LWA2, JD COMPOSITED Subsamples, CONTAINERIZED AND LABELED

0915: HEALTH AND SAFETY FOR WATER SAMPLING
- will take water samples first then Sed's STARTING AT downstream location
- AFTER Samples are collected, will take FLOW

0957: AT FAMSWSD003 – DOWN GRADIENT LOCATION, COLLECTED SW and Sediment SAMPLE WHERE TWO SMALL BRANCHES Converge. will take Flow [illegible]

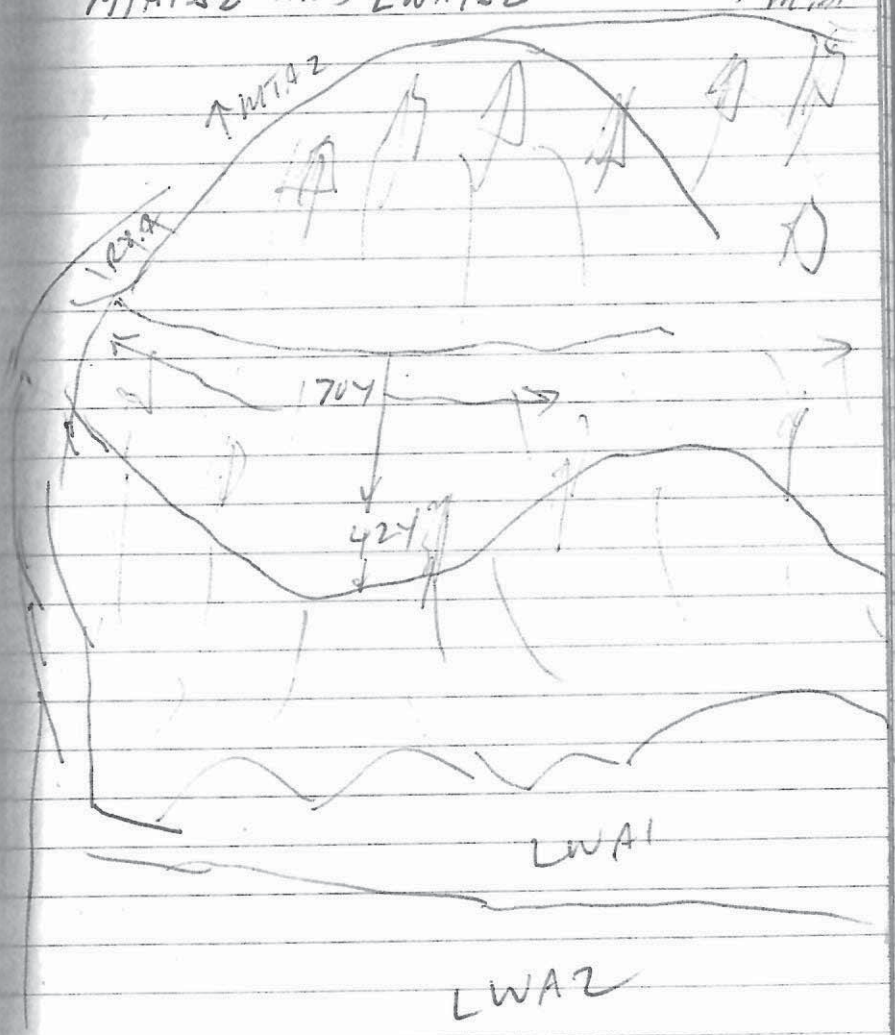
1020: AT CAR LABELING SAMPLES, JD TAKING WATER quality
SD003, TIME 10:00
SW003, TIME 0955

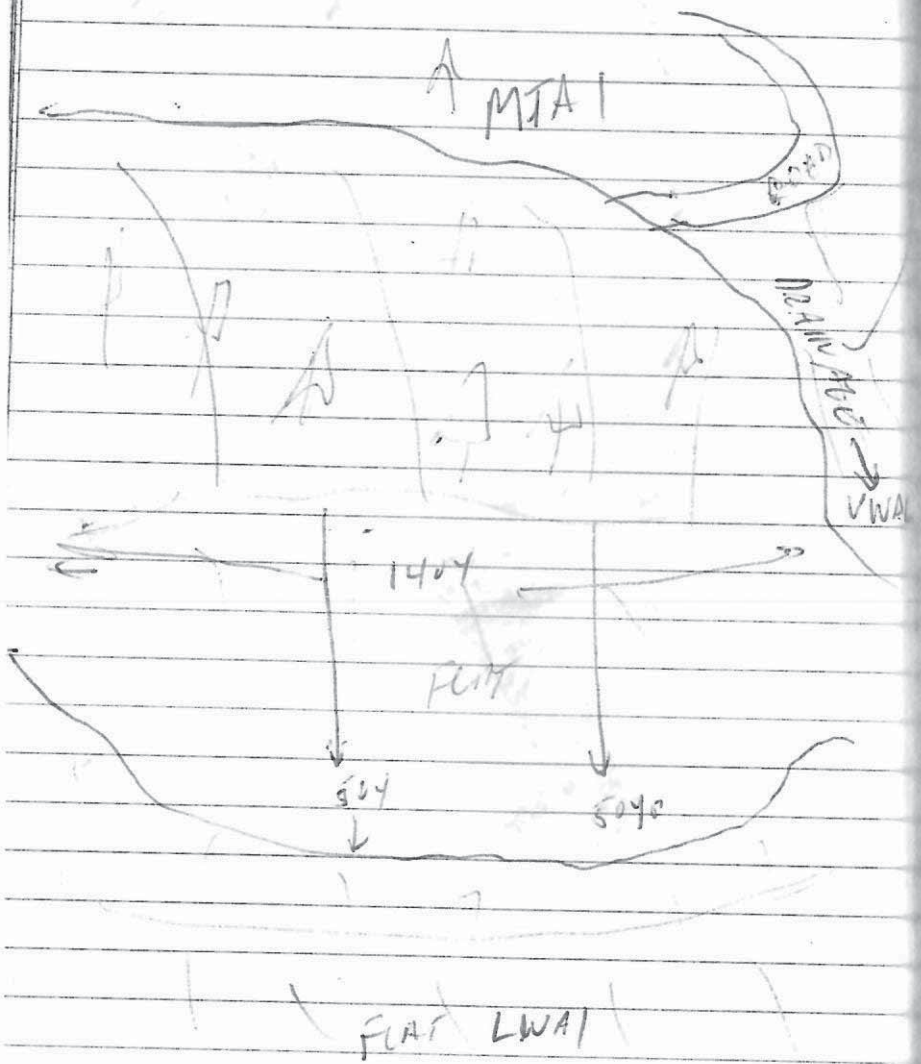
1035: FINISHED LABELING TO Mill.

1155: LABELED and PACKED ALL SAMPLES FROM FAM-TL-SWSD002 BELOW Mill. DUPE collected Here

Normal sample:
FHM-TC-SW002 AT 11:00
FHM-TC-SD002 AT 11:05
DUPE SAMPLE:
FHM-TC-SW004 AT 12:00
FHM-TC-SD004 AT 12:05
NOTED ANIMAL SCAT, POSSIBLY BEAR. WILL ASK CAROLYN.
ALSO MOOSE. JOHN O. SAW BULL MOOSE AND TWO COWS IN WETLAND WEST OF MTA1.
1215: AT BACKGROUND SWSD LOCATION DIRECTLY BELOW POND OUTLET = BEFORE STREAM DIVERGENCE IN SMALL POND WITH OUTFLOW in 2 DIRECTIONS.
SETTING UP TO SAMPLE SW FHM-TC-SWSD003
1430: COMPLETED FLOW MEASUREMENTS AT SWSD001 AND SWSD002 AT ~~STSW~~ SWSD003, DOWNGLADIENT FOR FLOW.
1500: COMPLETED FLOW MEASUREMENT AT SWSD003. WILL LOOK FOR REPOSITORY LOCATIONS.

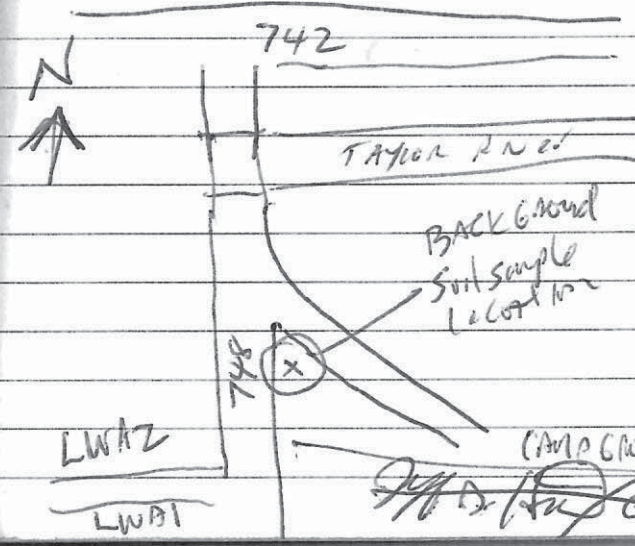
1510: AT NORTH SIDE OF HILL BETWEEN MTA1&2 AND LWA1&2





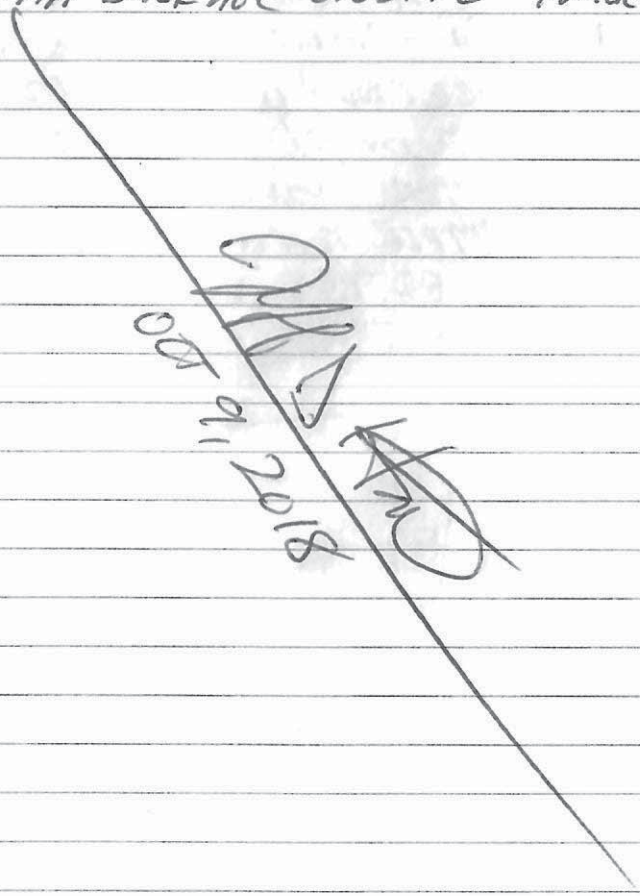
1625: JD + JH DRIVE WESTON ACCESS ROAD BETWEEN LWA1 AND LWA2 TO LOOK FOR REPOSITORY LOCATIONS
- SIMILAR GROUNDS WEST OF LWA2, BUT MORE TREES AND NOT AS ELEVATED, OPTION 2

1630: JH COLLECTION SOIL SAMPLE (BACKGROUND) FOR NATURAL NUTRIENTS/ GRAINSIZE/ ORGANIC MATTER / ADA.
SAMPLE COLLECTION JUST WEST OF FR 748 AT JUNCTION TO CAMP AREA APPROX 500 FT N OF LWA12 ACCESS ROAD



JD + JH Oct 9, 2018

1640: JH + JD off site
JH to visit Curris Cross tomorrow
at the GMUG NF HQ in
Delta, Co.
JD to complete volume study
with backhoe onsite tomorrow



FHM-FMU-SS-001

SAMPLE LOG FOREST HILL MILL SITE

SAMPLE ID	Date	Time	Type	Analyses	Remarks
FMU-001	10-8-18	09:40	Soil	Metals, Nutr, ABA	MS/MSD
~~FML-001~~ → FHM-FML-SS-001	10-8-18	10:45	Soil	Metals, Nutr, ABA	
FHM-UWA1SS-001	10-8-18	12:20	Soil	Metals, ABA, Water,	
FHM-UWA2-SS-001	10-8-18	13:15	Soil	Metals only	New Area
FHM-MTA2-SS-001	10-8-18	14:35	Soil	Metals, ABA, Water	Duplicate called FHM-UA-SS-001 Dupe for metals only
FHM-MTA1-SS-001	10-8-18	15:30	Soil	ABA & Nutr Only	Metals Done
FHM-LWA1-SS-001	"	16:45	Soil	Metals, ABA, Nutr	
FHM-LWA2-SS-001	10-9-18	08:30	Soil	Metals, ABA, Nutr	
FHM-TC-~~SD~~-SW-003	10-9-18	09:55	Water	Metals & Hardness	
FHM-TC-SD-003	10-9-18	10:00	Sed	Metals	
FHM-TC-SW-002	10-9-18	11:00	Water	Metals & Hardness	Dupe SW-004 12:00 10-9-18
FHM-TC-SD-~~002~~ 004	"	11:05	Sed	Metals	Dupe sed - 004 12:05 10-9-18
FHM-TC-SW-001	10-9-18	12:25	Water	Metals & Hg	MS/MSD T & MS/MSD Filt
FHM-TC-SD-001	10-9-18	12:30	Sed	Metals	~~MS/MSD~~ 802 Jar MS/MSD 802 Jar

FMU-001 FHM 004 (FML 001 Dup 007)

10-8-18 12:00 FHM-UA-SS-001


MTA1004
MTA1003
MTA1005
MTA1006
MTA1002
MTA1007

GMUG Forest Hill Repository Pits, October 10, 2018

East Repository Test Pit

0 to 6 inches bgs:
Topsoil Dark Brown, Roots and organic materials, moist
6 inches to 3.5 feet bgs:
Alluvium, SAND, Brn, with gravel and cobbles, occasional small boulders up to 12-inch diameter, rounded
3.5 feet to 6 feet bgs:
Alluvium, Sand and Gravel, tan-grayish brn, dry to damp, uniform, gravels rounded and up to 1/1/2 inch diameter (pit-run type gravels) (extends deeper than 6 feet - extent of mini-excavator)

West Repository Test Pit

0 to 6 inches bgs:
Topsoil Dark Brown, Roots and organic materials, moist
6 inches to 4.0 feet bgs:
Alluvium, SAND, Brn, slightly cohesive with gravel and cobbles, occasional small boulders up to 12-inch diameter, rounded unconsolidated
4.0 feet to 6 feet bgs:
Alluvium, Tan-graysih Sand and Gravel, dry to damp, uniform, gravels rounded (pit run type gravels) (extends deeper than 6 feet - extent of mini-excavator)

Forest Hill Mill and Tailings Washout Project Site
Gunnison National Forest

Date: ____ 10/9/2018
Time: 12:45 PM

FLOW MEASUREMENT DATA SHEET

Station ID: FHM-TC-SWSD001

Directly downgradient from the culverts and upgradient from the Forest Hill Mill on Trail Creek

Readings	Distance from Edge (ft)	Avg. Velocity (ft/sec.)	Depth (ft.)	Total Width (ft.)	Segment	Ave V (ft/sec)	Ave D (ft)	Seg Width (ft)	Flow/Seg (CFS)
1	0	1.6	0.7	1	0-1	1.1	0.5	1	0.6
2	1	0.6	0.4	1	1-2	0.8	0.5	1	0.4
3	2	1	0.5	1	2-3	0.9	0.6	1	0.5
4	3	0.7	0.7	1	3-4	1.4	0.4	1	0.5
5	4	2	0.1	1	4-5	1.1	0.4	1	0.4
6	5	0.2	0.7						
					Sum of flow from each segment				2.4

Total Flow 2.4 CFS

Forest Hill Mill and Tailings Washout Project Site
Gunnison National Forest

Date: ____ 10/9/2018
Time: 13:45 PM

FLOW MEASUREMENT DATA SHEET

Station ID: FHM-TC-SWSD002

Directly West and Adjacent to Forest Hill Mill on Trail Creek

Readings	Distance from Edge (ft)	Avg. Velocity (ft/sec.)	Depth (ft.)	Total Width (ft.)	Segment	Ave V (ft/sec)	Ave D (ft)	Seg Width (ft)	Flow/Seg (CFS)
1	0	0	0.0	5	0-1	0.0	0.3	1	0.0
2	1	0	0.5		1-2	0.7	0.5	1	0.4
3	2	1.4	0.5		2-3	1.0	0.4	1	0.4
4	3	0.5	0.3		3-4	0.8	0.4	1	0.3
5	4	1	0.5		4-5	1.0	0.5	1	0.5
6	5	1	0.6		5-6	0.6	0.5	1	0.3
7	6	0.2	0.5		6-7	0.3	0.5	1	0.1
8	7	0.3	0.5		7-8	0.3	0.5	1	0.2
9	8	0.3	0.5		8-9	0.2	0.6	1	0.1
	9	0	0.6						0.0
					Sum of flow from each segment				2.3

Total Flow 2.3 CFS

Forest Hill Mill and Tailings Washout Project Site **Date: ____ 10/9/2018**
Gunnison National Forest **Time: 14:45PM**

FLOW MEASUREMENT DATA SHEET Station ID: FHM-TC-SWSD003

Directly downgradient from the culverts and upgradient from the Forest Hill Mill on Trail Creek

Readings	Distance from Edge (ft)	Avg. Velocity (ft/sec.)	Depth (ft.)	Total Width (ft.)	Segment	Ave V (ft/sec)	Ave D (ft)	Seg Width (ft)	Flow/Seg (CFS)
1	0	1.5	0.8	5	0-1	1.6	0.9	1	1.3
2	1	1.6	0.9		1-2	1.2	0.8	1	1.0
3	2	0.7	0.7		2-3	0.7	0.6	1	0.4
4	3	0.7	0.5		3-4	0.7	0.5	1	0.3
					Sum of flow from each segment				3.0
		Total Flow		**3.0 CFS**					

Applied Intellect

2801 Youngfield St., Ste 250
Golden, CO 80401

Billing Information: SAME

Report to: **John DeAngelis**

Email To: **john.deangelis@ap-in.com**

Project Description: Forest Hill Mill

City/State Collected: Gunnison county, CO

Phone: 303 246 8864
Fax:

Client Project #

Lab Project #

Collected by (print): John A DeAngelis

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N X Y ____

Rush? (Lab MUST Be Notified)
____ Same Day ____ Five Day
____ Next Day ____ 5 Day (Rad Only)
____ Two Day ____ 10 Day (Rad Only)
____ Three Day

Quote #

Date Results Needed: Normal T.O.

Pres Chk

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Metals* - 4oz Soil Jar	# Containers	Total Metals & Diss. Metals* - 250ml HDPE+	Hardness - 250ml HDPE w/HN03									Remarks	Sample # (lab only)
FHM-																				
FHM-FMW-SS-001	Comp	Soil	Surf.	10-8-18	09:40	1	X	1											ms/msD	
FHM-FMW-SS-001	Comp	Soil	Surf.	10-8-18	10:45	1	X	1												
FHM-UWA1-SS-001	Comp	Soil	Surf.	10-8-18	12:20	1	X	1												
FHM-UWA2-SS-001	Comp	Soil	Surf.	10-8-18	13:15	1	X	1												
FHM-MTA2-SS-001	Comp	Soil	Surf.	10-8-18	14:35	1	X	1												
FHM-LWA1-SS-001	Comp	Soil	Surf.	10-8-18	16:45	1	X	1												
FHM-LWA2-SS-001	Comp	Soil	Surf.	10-9-18	08:30	1	X	1												
FHM-TC-SD-001	Grab	SED	SED	10-9-18	12:30	1	X	1-8oz											ms/msD	
FHM-TC-SD-002	Grab	SED	SED	10-9-18	11:05	1	X	1												

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L #

Table #

Acctnum: **APPINTGCO**

Template:

Prelogin:

TSR:

PB:

Shipped Via:

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

Metals: Sb,As,Cd,Cr,Cu,Fe,Pb,Mn,Hg,Ni,Se,Ag,Zn

pH _____ Temp _____

Flow _____ Other _____

Samples returned via: Hand Delivered
__ UPS __ FedEx __ Courier __ _____

Tracking #

Sample Receipt Checklist
COC Seal Present/Intact: __NP __Y __N
COC Signed/Accurate: __Y __N
Bottles arrive intact: __Y __N
Correct bottles used: __Y __N
Sufficient volume sent: __Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR	
	10-12-18	1013			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: °C Bottles Received:	If preservation required by Login: Date/Time
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: Time:	Hold: / Condition: NCF / OK

Applied Intellect

2801 Youngfield St., Ste 250
Golden, CO 80401

Billing Information: SAME

Pres Chk

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

Pace Analytical® National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

Report to: **John DeAngelis**

Email To: **john.deangelis@ap-in.com**

Project Description: Forest Hill Mine

City/State Collected: Gunnison County, CO

Phone: 303 296-8611
Fax:

Client Project #

Lab Project #

L #

Collected by (print): John A. DeAngelis

Site/Facility ID #

P.O. #

Table #

Acctnum: **APPINTGCO**

Collected by (signature):

Immediately Packed on Ice N X Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed: Normal T.O.

Template:

Prelogin:

TSR:

PB:

Shipped Via:

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Metals* - 4oz Soil Jar		Total Metals & Diss. Metals* - 250ml HDPE	Hardness - 250ml HDPE w/HN03							Remarks	Sample # (lab only)
FHM-TC-SD-003	Grab	SED	SED	10-9-18	10:00	1	X											
FHM-UA-SS-001	Comp	Soil	Surf.	10-8-18	12:00	1	X											
FHM-TC-SD-004	Grab	SED	SED	10-9-18	12:05	1	X											
FHM-TC-SW-001	Grab	SW	NA	10-9-18	12:25	2			X	X								
FHM-TC-SW-002	Grab	SW	NA	10-9-18	11:00	2			X	X								
FHM-TC-SW-003	Grab	SW	NA	10-9-18	10:00	4			X	X							MS/MSD	
FHM-TC-SW-004	Grab	SW	NA	10-9-18	12:00	2			X	X								

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
Metals: Sb,As,Cd,Cr,Cu,Fe,Pb,Mn,Hg,Ni,Se,Ag,Zn

pH _____ Temp _____

Flow _____ Other _____

Samples returned via: Hand Delivered
__ UPS __ FedEx __ Courier _____

Tracking #

Sample Receipt Checklist

COC Seal Present/Intact:	__NP	__Y __N
COC Signed/Accurate:		__Y __N
Bottles arrive intact:		__Y __N
Correct bottles used:		__Y __N
Sufficient volume sent:		__Y __N
If Applicable		
VOA Zero Headspace:		__Y __N
Preservation Correct/Checked:		__Y __N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR	
	10-12-18	1013			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: °C Bottles Received:	If preservation required by Login: Date/Time
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: Time:	Hold: / Condition: NCF / OK

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: John DeAngelis	Address: 2801 Youngfield St. #240
Company: Applied Intellect LLC	Golden, CO 80401
E-mail: john.deangelis@ap-in.com	Telephone: 303 246 8864

Copy of Report to:

Name: SAME	E-mail: SAME
Company:	Telephone:

Invoice to:

Name: SAME	Address: SAME
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☒

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: John DeAngelis **Sampler's Site Information** **State** CO **Zip code** Gunnison County **Time Zone** MST

***Sampler's Signature:** [signature]

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #: Mineral Park Mill

PO#:

Reporting state for compliance testing: NA

Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	ABA Paste pH								
FHM-FMU-SS-001	10-8-18 09:40	Soil	1	X								
FHM-FML-SS-001	10-8-18 10:45	Soil	1	X								
FHM-UWA1-SS-001	10-8-18 12:20	Soil	1	X								
FHM-MTA2-SS-001	10-8-18 14:35	Soil	1	X								
FHM-MTA1-SS-001	10-8-18 15:30	Soil	1	X								
FHM-LWA1-SS-001	10-8-18 16:45	Soil	1	X								
FHM-LWA2-SS-001	10-9-18 08:30	Soil	1	X								

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Analyses do not require preservation of samples with ice.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
[signature]	10-12-18 14:15		

CSU SOIL, WATER AND PLANT TESTING LABORATORY

200 W Lake St A320 NESB
1120 CAMPUS DELIVERY (physical address 1231 East Drive)
FORT COLLINS, CO 80523-1120 Phone 970-491-5061/Fax 970-491-2930

Colorado State University

NAME John DeAngelis (Customer/Contact) Applied Intellect LLC (Business)

CUSTOMER ADDRESS: 2801 Youngfield St. #240 (Street/P O Box)

Golden (City) CO (State) 80401 (Zip code)

Customer Phone No.: 303 246 8864 Customer Fax No.** None

** Please provide this information so that results can be provided without delays for mailing and billing times.

E-Mail if available john.deangelis@ap-in.com

ON-CAMPUS CUSTOMER BILLING INFORMATION

Name of Department to be billed: NA

Account Number: X

(Students) Instructor/Advisor Name:

OFF CAMPUS CUSTOMER BILLING INFORMATION

Complete information for payment by credit card-

Discover [ ]
MasterCard [ ] Name on Card: AJIT LOUIS Expiration Date: 11-2023
Visa [X] Card Number: 4246 3152 ~~4569~~ 5694 2069

PO number, Project name/number needed to be seen on invoice: EN 18 005 Forest Hill

By accepting service or goods, I agree to submit payment in full to Colorado State University upon receipt of invoice or University Billing Statement. Late payment charges of 1.5% per month and other penalties specified may be addressed for late payment.

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE **MINIMUM CHARGE $15.00**

DATE SUBMITTED: 10/18/2018 DATE NEEDED: Standard

LAB NO. *for lab use only*	YOUR SAMPLE ID	ANALYSIS REQUESTED
	FHM-FMU-55-001	Soil & Overburden Routine
	FHM-FML-55-001	"
	FHM-MTA1-55-001	"
	FHM-MTA2-55-001	"
	FHM-LWA1-55-001	"
	FHM-LWA2-55-001	"
	FHM-UWA-55-001	"
	FHM-REP-55-001	"

TOTAL NUMBER OF SAMPLES: 8

SAMPLE DISPOSAL INFORMATION: Return to Originator_____ OR Destroy ✓

Due to lack of storage space, the lab must discard samples 30 days after the customer receives results. If samples need to be returned, please pick-up or arrange for return prior to that time. If samples or containers need to be returned by mail, postage and handling fee will be assessed.

If samples need to be stored here there will be a one time fee of $4.50 per sample charge to the customer.
Please initial here to acknowledge that you have read the above statement JAD

CHAIN OF CUSTODY (IF NEEDED)

	Printed Name	Signature	Date	Time
Relinquished by:	John A. DeAngelis		10-18-18	12:00
Received by:				

Send to:Soil, Water & Plant Testing Laboratory, 200 W. Lake St. Campus Delivery 1120, Fort Collins CO 80523-1120

For directions to the lab go back to the main page and scroll to the bottom of the page.
Visit our web site at: http://www.soiltestinglab.colostate.edu

Appendix B
Analytical Data Soil Report L47579
Dated November 1, 2018 Forest Hill Mill
ACZ Analytical Laboratory

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

November 01, 2018

Report to:
John DeAngelis
Applied Intellect LLC
2801 Youngfield St., Suite 240

Golden, CO 80401

Bill to:
John DeAngelis
Applied Intellect LLC
2801 Youngfield Street
#240
Golden, CO 80440

Project ID:
ACZ Project ID: L47579

John DeAngelis:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on October 15, 2018. This project has been assigned to ACZ's project number, L47579. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L47579. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after December 01, 2018. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Max Janicek has reviewed and approved this report.

Applied Intellect LLC
Project ID:
Sample ID: FHM-FMU-SS-001

ACZ Sample ID: ***L47579-01***
Date Sampled: *10/08/18 09:40*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 3.2.4		4.69			t CaCO3/Kt	0.31	3.1	11/01/18 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		3.0			t CaCO3/Kt	1	5	11/01/18 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		-1.7			t CaCO3/Kt			11/01/18 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1	0.3	B	*	%	0.1	0.5	10/29/18 11:05	jlw
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	250		*	um			11/01/18 0:00	llr
pH		1	5.1		*	units	0.1	0.1	11/01/18 0:00	llr
Sulfur Forms	M600/2-78-054 3.2.4-MOD									
Sulfur HCl Residue		1	0.12		*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur HNO3 Residue		1	0.01	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Organic Residual		1	0.01	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Pyritic Sulfide		1	0.11			%	0.01	0.1	10/26/18 0:00	llr
Sulfur Sulfate		1	0.03	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Total		1	0.15		*	%	0.01	0.1	10/26/18 0:00	llr
Total Sulfur minus Sulfate		1	0.12			%	0.01	0.1	10/26/18 0:00	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								10/19/18 13:40	llr
Crush and Pulverize (Ring & Puck)	EPA-600/2-78-054 3.1.3								10/23/18 9:30	llr
Saturated Paste Extraction	USDA No. 60 (2)								10/31/18 11:46	llr

Applied Intellect LLC
Project ID:
Sample ID: FHM-FML-SS-001

ACZ Sample ID: ***L47579-02***
Date Sampled: *10/08/18 10:45*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 3.2.4		92.2			t CaCO3/Kt	0.31	3.1	11/01/18 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		0.0			t CaCO3/Kt	1	5	11/01/18 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		-92.2			t CaCO3/Kt			11/01/18 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1		U	*	%	0.1	0.5	10/29/18 11:45	jlw
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	250		*	um			11/01/18 0:00	llr
pH		1	4.3		*	units	0.1	0.1	11/01/18 0:00	llr
Sulfur Forms	M600/2-78-054 3.2.4-MOD									
Sulfur HCl Residue		1	2.20		*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur HNO3 Residue		1	0.09	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Organic Residual		1	0.09	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Pyritic Sulfide		1	2.11			%	0.01	0.1	10/26/18 0:00	llr
Sulfur Sulfate		1	0.75		*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Total		1	2.95		*	%	0.01	0.1	10/26/18 0:00	llr
Total Sulfur minus Sulfate		1	2.20			%	0.01	0.1	10/26/18 0:00	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								10/19/18 13:42	llr
Crush and Pulverize (Ring & Puck)	EPA-600/2-78-054 3.1.3								10/23/18 9:42	llr
Saturated Paste Extraction	USDA No. 60 (2)								10/31/18 11:48	llr

Applied Intellect LLC
Project ID:
Sample ID: FHM-UWA1-SS-001

ACZ Sample ID: ***L47579-03***
Date Sampled: *10/08/18 12:20*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 3.2.4		11.3			t CaCO3/Kt	0.31	3.1	11/01/18 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		0.0			t CaCO3/Kt	1	5	11/01/18 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		-11.3			t CaCO3/Kt			11/01/18 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1		U	*	%	0.1	0.5	10/29/18 11:59	jlw
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	250		*	um			11/01/18 0:00	llr
pH		1	4.8		*	units	0.1	0.1	11/01/18 0:00	llr
Sulfur Forms	M600/2-78-054 3.2.4-MOD									
Sulfur HCl Residue		1	0.24		*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur HNO3 Residue		1	0.02	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Organic Residual		1	0.02	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Pyritic Sulfide		1	0.22			%	0.01	0.1	10/26/18 0:00	llr
Sulfur Sulfate		1	0.12		*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Total		1	0.36		*	%	0.01	0.1	10/26/18 0:00	llr
Total Sulfur minus Sulfate		1	0.24			%	0.01	0.1	10/26/18 0:00	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								10/19/18 13:44	llr
Crush and Pulverize (Ring & Puck)	EPA-600/2-78-054 3.1.3								10/23/18 9:55	llr
Saturated Paste Extraction	USDA No. 60 (2)								10/31/18 11:50	llr

Applied Intellect LLC
Project ID:
Sample ID: FHM-MTA2-SS-001

ACZ Sample ID: ***L47579-04***
Date Sampled: *10/08/18 14:35*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 3.2.4		5.63			t CaCO3/Kt	0.31	3.1	11/01/18 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		2.0			t CaCO3/Kt	1	5	11/01/18 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		-3.6			t CaCO3/Kt			11/01/18 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1	0.2	B	*	%	0.1	0.5	10/29/18 12:12	jlw
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	250		*	um			11/01/18 0:00	llr
pH		1	5.2		*	units	0.1	0.1	11/01/18 0:00	llr
Sulfur Forms	M600/2-78-054 3.2.4-MOD									
Sulfur HCl Residue		1	0.12		*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur HNO3 Residue		1	0.02	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Organic Residual		1	0.02	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Pyritic Sulfide		1	0.10			%	0.01	0.1	10/26/18 0:00	llr
Sulfur Sulfate		1	0.06	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Total		1	0.18		*	%	0.01	0.1	10/26/18 0:00	llr
Total Sulfur minus Sulfate		1	0.12			%	0.01	0.1	10/26/18 0:00	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								10/19/18 13:47	llr
Crush and Pulverize (Ring & Puck)	EPA-600/2-78-054 3.1.3								10/23/18 10:07	llr
Saturated Paste Extraction	USDA No. 60 (2)								10/31/18 11:52	llr

Applied Intellect LLC
Project ID:
Sample ID: FHM-MTA1-SS-001

ACZ Sample ID: ***L47579-05***
Date Sampled: *10/08/18 15:30*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 3.2.4		8.13			t CaCO3/Kt	0.31	3.1	11/01/18 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		0.0			t CaCO3/Kt	1	5	11/01/18 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		-8.1			t CaCO3/Kt			11/01/18 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1		U	*	%	0.1	0.5	10/29/18 12:25	jlw
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	250		*	um			11/01/18 0:00	llr
pH		1	4.6		*	units	0.1	0.1	11/01/18 0:00	llr
Sulfur Forms	M600/2-78-054 3.2.4-MOD									
Sulfur HCl Residue		1	0.15		*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur HNO3 Residue		1	0.02	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Organic Residual		1	0.02	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Pyritic Sulfide		1	0.13			%	0.01	0.1	10/26/18 0:00	llr
Sulfur Sulfate		1	0.11		*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Total		1	0.26		*	%	0.01	0.1	10/26/18 0:00	llr
Total Sulfur minus Sulfate		1	0.15			%	0.01	0.1	10/26/18 0:00	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								10/19/18 13:49	llr
Crush and Pulverize (Ring & Puck)	EPA-600/2-78-054 3.1.3								10/23/18 10:20	llr
Saturated Paste Extraction	USDA No. 60 (2)								10/31/18 11:54	llr

Applied Intellect LLC
Project ID:
Sample ID: FHM-LWA1-SS-001

ACZ Sample ID: ***L47579-06***
Date Sampled: *10/08/18 16:45*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 3.2.4		2.50	B		t CaCO3/Kt	0.31	3.1	11/01/18 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		3.0			t CaCO3/Kt	1	5	11/01/18 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		0.5			t CaCO3/Kt			11/01/18 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1	0.3	B	*	%	0.1	0.5	10/29/18 12:39	jlw
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	250		*	um			11/01/18 0:00	llr
pH		1	5.2		*	units	0.1	0.1	11/01/18 0:00	llr
Sulfur Forms	M600/2-78-054 3.2.4-MOD									
Sulfur HCl Residue		1	0.05	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur HNO3 Residue		1	0.01	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Organic Residual		1	0.01	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Pyritic Sulfide		1	0.04	B		%	0.01	0.1	10/26/18 0:00	llr
Sulfur Sulfate		1	0.03	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Total		1	0.08	B	*	%	0.01	0.1	10/26/18 0:00	llr
Total Sulfur minus Sulfate		1	0.05	B		%	0.01	0.1	10/26/18 0:00	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								10/19/18 13:51	llr
Crush and Pulverize (Ring & Puck)	EPA-600/2-78-054 3.1.3								10/23/18 10:32	llr
Saturated Paste Extraction	USDA No. 60 (2)								10/31/18 11:56	llr

Applied Intellect LLC
Project ID:
Sample ID: FHM-LWA2-SS-001

ACZ Sample ID: ***L47579-07***
Date Sampled: *10/09/18 08:30*
Date Received: *10/15/18*
Sample Matrix: *Soil*

Soil Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Acid Generation Potential (calc on Sulfur total)	M600/2-78-054 3.2.4		1.56	B		t CaCO3/Kt	0.31	3.1	11/01/18 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		3.0			t CaCO3/Kt	1	5	11/01/18 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		1.4			t CaCO3/Kt			11/01/18 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1	0.3	B	*	%	0.1	0.5	10/29/18 13:06	jlw
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	250		*	um			11/01/18 0:00	llr
pH		1	5.5		*	units	0.1	0.1	11/01/18 0:00	llr
Sulfur Forms	M600/2-78-054 3.2.4-MOD									
Sulfur HCl Residue		1	0.03	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur HNO3 Residue		1	0.01	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Organic Residual		1	0.01	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Pyritic Sulfide		1	0.02	B		%	0.01	0.1	10/26/18 0:00	llr
Sulfur Sulfate		1	0.02	B	*	%	0.01	0.1	10/26/18 0:00	llr
Sulfur Total		1	0.05	B	*	%	0.01	0.1	10/26/18 0:00	llr
Total Sulfur minus Sulfate		1	0.03	B		%	0.01	0.1	10/26/18 0:00	llr

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								10/19/18 13:54	llr
Crush and Pulverize (Ring & Puck)	EPA-600/2-78-054 3.1.3								10/23/18 10:45	llr
Saturated Paste Extraction	USDA No. 60 (2)								10/31/18 11:58	llr

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1)	EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2)	EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3)	EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4)	EPA SW-846. Test Methods for Evaluating Solid Waste.
(5)	Standard Methods for the Examination of Water and Wastewater.

Comments

(1)	QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2)	Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3)	Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4)	An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5)	If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

REP001.03.15.02

Applied Intellect LLC

ACZ Project ID: ***L47579***

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Neutralization Potential as CaCO3 M600/2-78-054 3.2.3

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG459442													
WG459442PBS	PBS	10/29/18 10:38				U	%		-0.2	0.2			
WG459442LCSS	LCSS	10/29/18 10:52	PCN57279	4.96		4.98	%	100	80	120			
L47579-01MS	MS	10/29/18 11:18	SI141024-1	1	.3	1.25	%	95	70	130			
L47579-01DUP	DUP	10/29/18 11:32			.3	.28	%				7	20	RA

pH, Saturated Paste EPA 600/2-78-054 section 3.2.2

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG459701													
WG459701ICV	ICV	11/01/18 8:06	PCN56119	4		3.9	units	98	3.9	4.1			
L47579-07DUP	DUP	11/01/18 8:27			5.5	5.48	units				0	20	

Sulfur Organic Residual M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG459084													
L47579-01DUP	DUP	10/26/18 16:39			.01	.02	%				67	20	RA

Sulfur Pyritic Sulfide M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG459084													
L47579-01DUP	DUP	10/26/18 16:39			.11	.1	%				10	20	

Sulfur Sulfate M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG459084													
WG459084PBS	PBS	10/26/18 16:25				U	%		-0.03	0.03			
L47579-01DUP	DUP	10/26/18 16:39			.03	.04	%				29	20	RA

Sulfur Total M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG459084													
WG459084PBS	PBS	10/26/18 14:10				U	%		-0.03	0.03			
WG459084LCSS	LCSS	10/26/18 14:14	PCN57364	3.82		3.69	%	97	80	120			
L47579-01MS	MS	10/26/18 14:20	PCN56535	1.32	.15	1.5	%	102	80	120			
L47579-01DUP	DUP	10/26/18 14:23			.15	.16	%				6	20	
WG459084LCSS	LCSS	10/26/18 15:13	PCN57364	3.82		3.65	%	96	80	120			
WG459084PBS	PBS	10/26/18 15:16				U	%		-0.03	0.03			

Total Sulfur Minus Sulfate M600/2-78-054 3.2.4-MOD

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG459084													
WG459084PBS	PBS	10/26/18 16:25				U	%		-0.03	0.03			
L47579-01DUP	DUP	10/26/18 16:39			.12	.12	%				0	20	

Applied Intellect LLC

ACZ Project ID: ***L47579***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L47579-01	WG459442	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG459084	Sulfur Organic Residual	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L47579-02	WG459442	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG459084	Sulfur Organic Residual	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L47579-03	WG459442	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG459084	Sulfur Organic Residual	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L47579-04	WG459442	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG459084	Sulfur Organic Residual	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L47579-05	WG459442	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG459084	Sulfur Organic Residual	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L47579-06	WG459442	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG459084	Sulfur Organic Residual	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
L47579-07	WG459442	Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG459084	Sulfur Organic Residual	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
		Sulfur Sulfate	M600/2-78-054 3.2.4-MOD	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

Applied Intellect LLC

ACZ Project ID: ***L47579***

Soil Analysis

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Neutralization Potential as CaCO3	M600/2-78-054 3.2.3
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2
Sulfur HNO3 Residue	M600/2-78-054 3.2.4-MOD

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Applied Intellect LLC

ACZ Project ID: L47579
Date Received: 10/15/2018 10:47
Received By: mjj
Date Printed: 10/15/2018

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?		X	
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	X		

A change was made in the Sample Identification: Date:Time, Line 3 section prior to ACZ custody.

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]			X
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		

NA indicates Not Applicable

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
4317	5.1	NA	15	Yes

Was ice present in the shipment container(s)?

No - Wet or gel ice was not present in the shipment container(s).

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Applied Intellect LLC

ACZ Project ID:	L47579
Date Received:	10/15/2018 10:47
Received By:	mjj
Date Printed:	10/15/2018

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc. L47579

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: John DeAngelis
Company: Applied Intellect LLC
E-mail: john.deangelis@ap-in.com
Address: 2801 Youngfield St. #240
Golden, CO 80401
Telephone: 303 246 8864

Copy of Report to:

Name: SAME
Company:
E-mail: SAME
Telephone:

Invoice to:

Name: SAME
Company:
E-mail:
Address: SAME
Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes ☐ No ☒

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: John A. DeAngelis **Sampler's Site Information** State CO Zip code Gunnison County Time Zone MST

***Sampler's Signature:** John A. DeAngelis

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION

Quote #: Mineral Park Mill
PO#:
Reporting state for compliance testing: NA
Check box if samples include NRC licensed material? ☐

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	ABA Paste pH							
FHM-FMU-SS-001	10-8-18 09:40	Soil	1	X							
FHM-FML-SS-001	10-8-18 10:45	Soil	1	X							
FHM-UWA1-SS-001	10-8-18 12:20	Soil	1	X							
FHM-MTA2-SS-001	10-8-18 14:35	Soil	1	X							
FHM-MTA1-SS-001	10-8-18 15:30	Soil	1	X							
FHM-LWA1-SS-001	10-8-18 16:45	Soil	1	X							
FHM-LWA2-SS-001	10-9-18 08:30	Soil	1	X							

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Analyses do not require preservation of samples with ice.

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
John DeAngelis	10-12-18 14:15	LAS	10/15/18 10:47

L47579 Chain of Custod

Appendix C

Analytical Data Soil Report R1576-R1583
Dated November 30, 2018 Forest Hill Mill
CSU Soil, Water, Plant Testing Laboratory

John DeAngeles/Applied Intellect LLC
2801 Youngfield St #240
Golden CO 80401

Colorado State University
Soil, Water and Plant Testing Laboratory
Natural & Environmental Sciences Bldg - A32(
Fort Collins, CO 80523-1120

(970) 491-5061 FAX: 491-2930

DATE RECEIVED: 10-22-2018
DATE REPORTED: 11-30-2018

BILLING:

RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	paste pH	paste EC mmhos/cm	Lime Estimate	% OM	AB-DTPA ppm NO_3-N	P	K	Zn	Fe	Mn	Cu	Texture Estimate
R1576	1	4.9	0.6	low	4.0	3.4	28.5	58.5	300	180	8.5	38.9	sandy loam
R1577	2	3.4	1.6	low	3.4	0.8	7.3	19.0	278	52.0	4.1	11.8	sandy loam
R1578	3	4.2	0.9	low	4.7	4.6	21.5	64.6	414	131	3.9	40.1	sandy loam
R1579	4	4.8	0.3	low	7.7	12.7	21.4	77.1	411	104	4.5	26.4	sandy loam
R1580	5	4.7	0.3	low	6.6	6.4	19.1	149	340	53.7	18.9	41.4	loam
R1581	6	4.8	0.3	low	6.3	6.8	16.9	125	410	21.1	6.0	18.6	loam
R1582	7	4.5	0.5	low	5.8	10.6	22.1	50.4	382	133	2.4	35.2	sandy loam
R1583	8	6.0	0.2	low	7.9	4.1	14.6	300	8.4	58.9	6.2	0.8	loam

R1576	1	FHM-FMU-SS-001
R1577	2	FHM-FML-SS-001
R1578	3	FHM-MTA1-SS-001
R1579	4	FHM-MTA2-SS-001
R1580	5	FHM-LWA1-33-001
R1581	6	FHM-LWA2-SS-001
R1582	7	FHM-UWA-SS-001
R1583	8	FHM-REP-SS-001

Appendix D

Analytical Data Soil and Water Report L1034679
Dated October 13, 2018, Forest Hill Mill
Pace Analytical Laboratory

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

October 22, 2018

Applied Intellect

Sample Delivery Group:	L1034679
Samples Received:	10/13/2018
Project Number:	
Description:	Forrest Hill Mill

Report To:

Jeffrey Hart
2801 Youngfield St.
Suite 240
Golden, CO 80401

Entire Report Reviewed By:

Chris Ward
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace National is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

FHM-FMU-SS-001 L1034679-01 Solid

Collected by: John DeAngelis | Collected date/time: 10/08/18 09:40 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	1	10/15/18 10:52	10/16/18 08:20	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 09:29	TRB

FHM-FML-SS-001 L1034679-02 Solid

Collected by: John DeAngelis | Collected date/time: 10/08/18 10:45 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	10	10/15/18 10:52	10/16/18 14:08	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 10:22	TRB
Metals (ICP) by Method 6010B	WG1180815	20	10/15/18 06:09	10/16/18 11:46	TRB

FHM-UWA1-SS-001 L1034679-03 Solid

Collected by: John DeAngelis | Collected date/time: 10/08/18 12:20 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	2	10/15/18 10:52	10/16/18 14:10	ABL
Metals (ICP) by Method 6010B	WG1180815	1.5625	10/15/18 06:09	10/16/18 10:25	TRB
Metals (ICP) by Method 6010B	WG1180815	7.8125	10/15/18 06:09	10/16/18 11:48	TRB

FHM-UWA2-SS-001 L1034679-04 Solid

Collected by: John DeAngelis | Collected date/time: 10/08/18 13:15 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	1	10/15/18 10:52	10/16/18 09:07	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 10:27	TRB
Metals (ICP) by Method 6010B	WG1180815	5	10/15/18 06:09	10/16/18 11:51	TRB

FHM-MTA-2-SS-001 L1034679-05 Solid

Collected by: John DeAngelis | Collected date/time: 10/08/18 14:35 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	1	10/15/18 10:52	10/16/18 09:14	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 10:30	TRB
Metals (ICP) by Method 6010B	WG1180815	5	10/15/18 06:09	10/16/18 11:53	TRB

FHM-LW1-SS-001 L1034679-06 Solid

Collected by: John DeAngelis | Collected date/time: 10/08/18 16:45 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	1	10/15/18 10:52	10/16/18 09:17	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 10:32	TRB

FHM-LWA2-SS-001 L1034679-07 Solid

Collected by: John DeAngelis | Collected date/time: 10/09/18 08:30 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	1	10/15/18 10:52	10/16/18 09:19	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 10:35	TRB

FHM-TC-SD-001 L1034679-08 Solid

Collected by: John DeAngelis | Collected date/time: 10/09/18 12:30 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	1	10/15/18 10:52	10/16/18 08:28	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 09:41	TRB

FHM-TC-SD-002 L1034679-09 Solid

Collected by: John DeAngelis | Collected date/time: 10/09/18 11:05 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	1	10/15/18 10:52	10/16/18 09:22	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 11:56	TRB

FHM-TC-SD-003 L1034679-10 Solid

Collected by: John DeAngelis | Collected date/time: 10/09/18 10:00 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	1	10/15/18 10:52	10/16/18 09:25	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 11:58	TRB

FHM-UA-SS-001 L1034679-11 Solid

Collected by: John DeAngelis | Collected date/time: 10/08/18 12:00 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	1	10/15/18 10:52	10/16/18 09:27	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 12:01	ST
Metals (ICP) by Method 6010B	WG1180815	5	10/15/18 06:09	10/16/18 12:58	ST

FHM-TC-SD-004 L1034679-12 Solid

Collected by: John DeAngelis | Collected date/time: 10/09/18 12:05 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7471A	WG1181080	1	10/15/18 10:52	10/16/18 09:30	ABL
Metals (ICP) by Method 6010B	WG1180815	1	10/15/18 06:09	10/16/18 12:03	TRB

FHM-TC-SW-001 L1034679-13 WW

Collected by: John DeAngelis | Collected date/time: 10/09/18 12:25 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 130.1	WG1181776	1	10/19/18 10:59	10/19/18 10:59	KK
Mercury by Method 245.1	WG1180786	1	10/14/18 15:55	10/15/18 09:48	ABL
Mercury by Method 245.1	WG1181184	1	10/15/18 16:35	10/16/18 08:39	ABL
Metals (ICP) by Method 200.7	WG1180493	1	10/15/18 17:10	10/16/18 09:52	CCE
Metals (ICP) by Method 200.7	WG1180937	1	10/15/18 17:04	10/16/18 13:06	ST

FHM-TC-SW-002 L1034679-14 WW

Collected by: John DeAngelis | Collected date/time: 10/09/18 11:00 | Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 130.1	WG1181776	1	10/19/18 11:02	10/19/18 11:02	KK
Mercury by Method 245.1	WG1180786	1	10/14/18 15:55	10/15/18 09:50	ABL
Mercury by Method 245.1	WG1181184	1	10/15/18 16:35	10/16/18 08:42	ABL
Metals (ICP) by Method 200.7	WG1180493	1	10/15/18 17:10	10/16/18 09:55	CCE

FHM-TC-SW-002 L1034679-14 WW

Collected by: John DeAngelis
Collected date/time: 10/09/18 11:00
Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Metals (ICP) by Method 200.7	WG1180937	1	10/15/18 17:04	10/16/18 13:08	ST

FHM-TC-SW-003 L1034679-15 WW

Collected by: John DeAngelis
Collected date/time: 10/09/18 10:00
Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 130.1	WG1181776	1	10/19/18 11:02	10/19/18 11:02	KK
Mercury by Method 245.1	WG1180786	1	10/14/18 15:55	10/15/18 09:26	ABL
Mercury by Method 245.1	WG1181184	1	10/15/18 16:35	10/16/18 08:32	ABL
Metals (ICP) by Method 200.7	WG1180493	1	10/15/18 17:10	10/16/18 09:07	CCE
Metals (ICP) by Method 200.7	WG1180937	1	10/15/18 17:04	10/16/18 12:34	ST

FHM-TC-SW-004 L1034679-16 WW

Collected by: John DeAngelis
Collected date/time: 10/09/18 12:00
Received date/time: 10/13/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 130.1	WG1181776	1	10/19/18 11:05	10/19/18 11:05	KK
Mercury by Method 245.1	WG1180786	1	10/14/18 15:55	10/15/18 09:52	ABL
Mercury by Method 245.1	WG1181184	1	10/15/18 16:35	10/16/18 08:44	ABL
Metals (ICP) by Method 200.7	WG1180493	1	10/15/18 17:10	10/16/18 09:58	CCE
Metals (ICP) by Method 200.7	WG1180937	1	10/15/18 17:04	10/16/18 13:11	ST

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Chris Ward

Chris Ward
Project Manager

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	0.0992	J6	0.00280	0.0200	1	10/16/2018 08:20	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	5.96	J3 J6	0.750	2.00	1	10/16/2018 09:29	WG1180815
Arsenic	10.0		0.460	2.00	1	10/16/2018 09:29	WG1180815
Cadmium	20.2	J3	0.0700	0.500	1	10/16/2018 09:29	WG1180815
Chromium	7.99		0.140	1.00	1	10/16/2018 09:29	WG1180815
Copper	83.4	O1	0.530	2.00	1	10/16/2018 09:29	WG1180815
Iron	15600	J3 O1 V	1.41	10.0	1	10/16/2018 09:29	WG1180815
Lead	932	V	0.190	0.500	1	10/16/2018 09:29	WG1180815
Manganese	234	J6 O1	0.120	1.00	1	10/16/2018 09:29	WG1180815
Nickel	5.06		0.490	2.00	1	10/16/2018 09:29	WG1180815
Selenium	U		0.620	2.00	1	10/16/2018 09:29	WG1180815
Silver	6.32		0.120	1.00	1	10/16/2018 09:29	WG1180815
Zinc	1360	J3 O1 V	0.590	5.00	1	10/16/2018 09:29	WG1180815

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	6.44		0.0280	0.200	10	10/16/2018 14:08	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	113		0.750	2.00	1	10/16/2018 10:22	WG1180815
Arsenic	64.6		0.460	2.00	1	10/16/2018 10:22	WG1180815
Cadmium	263		0.0700	0.500	1	10/16/2018 10:22	WG1180815
Chromium	2.47		0.140	1.00	1	10/16/2018 10:22	WG1180815
Copper	290		0.530	2.00	1	10/16/2018 10:22	WG1180815
Iron	13700		1.41	10.0	1	10/16/2018 10:22	WG1180815
Lead	8350		0.190	0.500	1	10/16/2018 10:22	WG1180815
Manganese	207		0.120	1.00	1	10/16/2018 10:22	WG1180815
Nickel	1.21	J	0.490	2.00	1	10/16/2018 10:22	WG1180815
Selenium	1.37	J	0.620	2.00	1	10/16/2018 10:22	WG1180815
Silver	94.2		0.120	1.00	1	10/16/2018 10:22	WG1180815
Zinc	29800		11.8	100	20	10/16/2018 11:46	WG1180815

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	1.35		0.00560	0.0400	2	10/16/2018 14:10	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	72.8		1.17	3.13	1.5625	10/16/2018 10:25	WG1180815
Arsenic	60.9		0.719	3.13	1.5625	10/16/2018 10:25	WG1180815
Cadmium	40.1		0.109	0.781	1.5625	10/16/2018 10:25	WG1180815
Chromium	6.25		0.219	1.56	1.5625	10/16/2018 10:25	WG1180815
Copper	258		0.828	3.13	1.5625	10/16/2018 10:25	WG1180815
Iron	13800		2.20	15.6	1.5625	10/16/2018 10:25	WG1180815
Lead	4910		0.297	0.781	1.5625	10/16/2018 10:25	WG1180815
Manganese	123		0.188	1.56	1.5625	10/16/2018 10:25	WG1180815
Nickel	2.69	J	0.766	3.13	1.5625	10/16/2018 10:25	WG1180815
Selenium	U		0.969	3.13	1.5625	10/16/2018 10:25	WG1180815
Silver	57.1		0.188	1.56	1.5625	10/16/2018 10:25	WG1180815
Zinc	3300		4.61	39.1	7.8125	10/16/2018 11:48	WG1180815

Mercury by Method 7471A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Mercury	0.0875		0.00280	0.0200	1	10/16/2018 09:07	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
Antimony	7.51		0.750	2.00	1	10/16/2018 10:27	WG1180815
Arsenic	8.68		0.460	2.00	1	10/16/2018 10:27	WG1180815
Cadmium	42.4		0.0700	0.500	1	10/16/2018 10:27	WG1180815
Chromium	11.7		0.140	1.00	1	10/16/2018 10:27	WG1180815
Copper	90.9		0.530	2.00	1	10/16/2018 10:27	WG1180815
Iron	18500		1.41	10.0	1	10/16/2018 10:27	WG1180815
Lead	933		0.190	0.500	1	10/16/2018 10:27	WG1180815
Manganese	493		0.120	1.00	1	10/16/2018 10:27	WG1180815
Nickel	7.74		0.490	2.00	1	10/16/2018 10:27	WG1180815
Selenium	U		0.620	2.00	1	10/16/2018 10:27	WG1180815
Silver	7.41		0.120	1.00	1	10/16/2018 10:27	WG1180815
Zinc	2140		2.95	25.0	5	10/16/2018 11:51	WG1180815

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	0.332		0.00280	0.0200	1	10/16/2018 09:14	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	26.6		0.750	2.00	1	10/16/2018 10:30	WG1180815
Arsenic	26.6		0.460	2.00	1	10/16/2018 10:30	WG1180815
Cadmium	30.1		0.0700	0.500	1	10/16/2018 10:30	WG1180815
Chromium	10.5		0.140	1.00	1	10/16/2018 10:30	WG1180815
Copper	161		0.530	2.00	1	10/16/2018 10:30	WG1180815
Iron	17500		1.41	10.0	1	10/16/2018 10:30	WG1180815
Lead	3110		0.190	0.500	1	10/16/2018 10:30	WG1180815
Manganese	264		0.120	1.00	1	10/16/2018 10:30	WG1180815
Nickel	5.64		0.490	2.00	1	10/16/2018 10:30	WG1180815
Selenium	U		0.620	2.00	1	10/16/2018 10:30	WG1180815
Silver	31.4		0.120	1.00	1	10/16/2018 10:30	WG1180815
Zinc	1960		2.95	25.0	5	10/16/2018 11:53	WG1180815

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	0.0641		0.00280	0.0200	1	10/16/2018 09:17	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	4.75		0.750	2.00	1	10/16/2018 10:32	WG1180815
Arsenic	6.47		0.460	2.00	1	10/16/2018 10:32	WG1180815
Cadmium	19.2		0.0700	0.500	1	10/16/2018 10:32	WG1180815
Chromium	14.6		0.140	1.00	1	10/16/2018 10:32	WG1180815
Copper	70.3		0.530	2.00	1	10/16/2018 10:32	WG1180815
Iron	17500		1.41	10.0	1	10/16/2018 10:32	WG1180815
Lead	496		0.190	0.500	1	10/16/2018 10:32	WG1180815
Manganese	602		0.120	1.00	1	10/16/2018 10:32	WG1180815
Nickel	8.99		0.490	2.00	1	10/16/2018 10:32	WG1180815
Selenium	U		0.620	2.00	1	10/16/2018 10:32	WG1180815
Silver	3.28		0.120	1.00	1	10/16/2018 10:32	WG1180815
Zinc	687		0.590	5.00	1	10/16/2018 10:32	WG1180815

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	0.0594		0.00280	0.0200	1	10/16/2018 09:19	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	5.00		0.750	2.00	1	10/16/2018 10:35	WG1180815
Arsenic	6.99		0.460	2.00	1	10/16/2018 10:35	WG1180815
Cadmium	23.0		0.0700	0.500	1	10/16/2018 10:35	WG1180815
Chromium	14.5		0.140	1.00	1	10/16/2018 10:35	WG1180815
Copper	64.4		0.530	2.00	1	10/16/2018 10:35	WG1180815
Iron	21000		1.41	10.0	1	10/16/2018 10:35	WG1180815
Lead	557		0.190	0.500	1	10/16/2018 10:35	WG1180815
Manganese	494		0.120	1.00	1	10/16/2018 10:35	WG1180815
Nickel	10.4		0.490	2.00	1	10/16/2018 10:35	WG1180815
Selenium	0.817	J	0.620	2.00	1	10/16/2018 10:35	WG1180815
Silver	4.83		0.120	1.00	1	10/16/2018 10:35	WG1180815
Zinc	1210		0.590	5.00	1	10/16/2018 10:35	WG1180815

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	U	J6	0.00280	0.0200	1	10/16/2018 08:28	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	U		0.750	2.00	1	10/16/2018 09:41	WG1180815
Arsenic	U		0.460	2.00	1	10/16/2018 09:41	WG1180815
Cadmium	0.118	J	0.0700	0.500	1	10/16/2018 09:41	WG1180815
Chromium	3.41		0.140	1.00	1	10/16/2018 09:41	WG1180815
Copper	0.761	J	0.530	2.00	1	10/16/2018 09:41	WG1180815
Iron	3720	J5	1.41	10.0	1	10/16/2018 09:41	WG1180815
Lead	1.42		0.190	0.500	1	10/16/2018 09:41	WG1180815
Manganese	213	J5	0.120	1.00	1	10/16/2018 09:41	WG1180815
Nickel	2.11		0.490	2.00	1	10/16/2018 09:41	WG1180815
Selenium	U		0.620	2.00	1	10/16/2018 09:41	WG1180815
Silver	U		0.120	1.00	1	10/16/2018 09:41	WG1180815
Zinc	16.2		0.590	5.00	1	10/16/2018 09:41	WG1180815

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	U		0.00280	0.0200	1	10/16/2018 09:22	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	U		0.750	2.00	1	10/16/2018 11:56	WG1180815
Arsenic	U		0.460	2.00	1	10/16/2018 11:56	WG1180815
Cadmium	2.57		0.0700	0.500	1	10/16/2018 11:56	WG1180815
Chromium	3.84		0.140	1.00	1	10/16/2018 11:56	WG1180815
Copper	1.49	J	0.530	2.00	1	10/16/2018 11:56	WG1180815
Iron	6380		1.41	10.0	1	10/16/2018 11:56	WG1180815
Lead	9.57		0.190	0.500	1	10/16/2018 11:56	WG1180815
Manganese	237		0.120	1.00	1	10/16/2018 11:56	WG1180815
Nickel	2.07		0.490	2.00	1	10/16/2018 11:56	WG1180815
Selenium	U		0.620	2.00	1	10/16/2018 11:56	WG1180815
Silver	U		0.120	1.00	1	10/16/2018 11:56	WG1180815
Zinc	105		0.590	5.00	1	10/16/2018 11:56	WG1180815

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	U		0.00280	0.0200	1	10/16/2018 09:25	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	U		0.750	2.00	1	10/16/2018 11:58	WG1180815
Arsenic	U		0.460	2.00	1	10/16/2018 11:58	WG1180815
Cadmium	0.183	J	0.0700	0.500	1	10/16/2018 11:58	WG1180815
Chromium	2.37		0.140	1.00	1	10/16/2018 11:58	WG1180815
Copper	1.18	J	0.530	2.00	1	10/16/2018 11:58	WG1180815
Iron	4720		1.41	10.0	1	10/16/2018 11:58	WG1180815
Lead	14.8		0.190	0.500	1	10/16/2018 11:58	WG1180815
Manganese	173		0.120	1.00	1	10/16/2018 11:58	WG1180815
Nickel	1.48	J	0.490	2.00	1	10/16/2018 11:58	WG1180815
Selenium	U		0.620	2.00	1	10/16/2018 11:58	WG1180815
Silver	U		0.120	1.00	1	10/16/2018 11:58	WG1180815
Zinc	31.1		0.590	5.00	1	10/16/2018 11:58	WG1180815

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	0.401		0.00280	0.0200	1	10/16/2018 09:27	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	27.0		0.750	2.00	1	10/16/2018 12:01	WG1180815
Arsenic	24.9		0.460	2.00	1	10/16/2018 12:01	WG1180815
Cadmium	32.1		0.0700	0.500	1	10/16/2018 12:01	WG1180815
Chromium	9.12		0.140	1.00	1	10/16/2018 12:01	WG1180815
Copper	167		0.530	2.00	1	10/16/2018 12:01	WG1180815
Iron	15600		1.41	10.0	1	10/16/2018 12:01	WG1180815
Lead	2990		0.190	0.500	1	10/16/2018 12:01	WG1180815
Manganese	287		0.120	1.00	1	10/16/2018 12:01	WG1180815
Nickel	5.18		0.490	2.00	1	10/16/2018 12:01	WG1180815
Selenium	U		0.620	2.00	1	10/16/2018 12:01	WG1180815
Silver	29.6		0.120	1.00	1	10/16/2018 12:01	WG1180815
Zinc	2000		2.95	25.0	5	10/16/2018 12:58	WG1180815

Mercury by Method 7471A

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Mercury	U		0.00280	0.0200	1	10/16/2018 09:30	WG1181080

Metals (ICP) by Method 6010B

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
Antimony	U		0.750	2.00	1	10/16/2018 12:03	WG1180815
Arsenic	U		0.460	2.00	1	10/16/2018 12:03	WG1180815
Cadmium	3.91		0.0700	0.500	1	10/16/2018 12:03	WG1180815
Chromium	4.90		0.140	1.00	1	10/16/2018 12:03	WG1180815
Copper	1.98	J	0.530	2.00	1	10/16/2018 12:03	WG1180815
Iron	7010		1.41	10.0	1	10/16/2018 12:03	WG1180815
Lead	7.11		0.190	0.500	1	10/16/2018 12:03	WG1180815
Manganese	197		0.120	1.00	1	10/16/2018 12:03	WG1180815
Nickel	2.54		0.490	2.00	1	10/16/2018 12:03	WG1180815
Selenium	U		0.620	2.00	1	10/16/2018 12:03	WG1180815
Silver	U		0.120	1.00	1	10/16/2018 12:03	WG1180815
Zinc	161		0.590	5.00	1	10/16/2018 12:03	WG1180815

Wet Chemistry by Method 130.1

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Hardness (colorimetric) as CaCO3	20.5	B J	1.43	30.0	1	10/19/2018 10:59	WG1181776

Mercury by Method 245.1

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Mercury	U		0.0000490	0.000200	1	10/15/2018 09:48	WG1180786
Mercury,Dissolved	U		0.0000490	0.000200	1	10/16/2018 08:39	WG1181184

Metals (ICP) by Method 200.7

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Antimony	U		0.00770	0.0100	1	10/16/2018 09:52	WG1180493
Antimony,Dissolved	U		0.00770	0.0100	1	10/16/2018 13:06	WG1180937
Arsenic	U		0.00640	0.0100	1	10/16/2018 09:52	WG1180493
Arsenic,Dissolved	U		0.00640	0.0100	1	10/16/2018 13:06	WG1180937
Cadmium	U		0.000700	0.00200	1	10/16/2018 09:52	WG1180493
Cadmium,Dissolved	U		0.000700	0.00200	1	10/16/2018 13:06	WG1180937
Chromium	U		0.00180	0.0100	1	10/16/2018 09:52	WG1180493
Chromium,Dissolved	U		0.00180	0.0100	1	10/16/2018 13:06	WG1180937
Copper	U		0.00700	0.0100	1	10/16/2018 09:52	WG1180493
Copper,Dissolved	U		0.00700	0.0100	1	10/16/2018 13:06	WG1180937
Iron	0.641		0.0282	0.100	1	10/16/2018 09:52	WG1180493
Iron,Dissolved	0.451		0.0282	0.100	1	10/16/2018 13:06	WG1180937
Lead	U		0.00200	0.00500	1	10/16/2018 09:52	WG1180493
Lead,Dissolved	U		0.00200	0.00500	1	10/16/2018 13:06	WG1180937
Manganese	0.0238		0.00200	0.0100	1	10/16/2018 09:52	WG1180493
Manganese,Dissolved	0.0129		0.00200	0.0100	1	10/16/2018 13:06	WG1180937
Nickel	U		0.00580	0.0100	1	10/16/2018 09:52	WG1180493
Nickel,Dissolved	U		0.00580	0.0100	1	10/16/2018 13:06	WG1180937
Selenium	U		0.00760	0.0100	1	10/16/2018 09:52	WG1180493
Selenium,Dissolved	U		0.00760	0.0100	1	10/16/2018 13:06	WG1180937
Silver	U		0.00270	0.00500	1	10/16/2018 09:52	WG1180493
Silver,Dissolved	U		0.00270	0.00500	1	10/16/2018 13:06	WG1180937
Zinc	U		0.00340	0.0500	1	10/16/2018 09:52	WG1180493
Zinc,Dissolved	0.0121	J	0.00340	0.0500	1	10/16/2018 13:06	WG1180937

Wet Chemistry by Method 130.1

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Hardness (colorimetric) as CaCO3	20.5	B J	1.43	30.0	1	10/19/2018 11:02	WG1181776

Mercury by Method 245.1

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Mercury	U		0.0000490	0.000200	1	10/15/2018 09:50	WG1180786
Mercury,Dissolved	U		0.0000490	0.000200	1	10/16/2018 08:42	WG1181184

Metals (ICP) by Method 200.7

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Antimony	U		0.00770	0.0100	1	10/16/2018 09:55	WG1180493
Antimony,Dissolved	U		0.00770	0.0100	1	10/16/2018 13:08	WG1180937
Arsenic	U		0.00640	0.0100	1	10/16/2018 09:55	WG1180493
Arsenic,Dissolved	U		0.00640	0.0100	1	10/16/2018 13:08	WG1180937
Cadmium	U		0.000700	0.00200	1	10/16/2018 09:55	WG1180493
Cadmium,Dissolved	U		0.000700	0.00200	1	10/16/2018 13:08	WG1180937
Chromium	U		0.00180	0.0100	1	10/16/2018 09:55	WG1180493
Chromium,Dissolved	U		0.00180	0.0100	1	10/16/2018 13:08	WG1180937
Copper	U		0.00700	0.0100	1	10/16/2018 09:55	WG1180493
Copper,Dissolved	U		0.00700	0.0100	1	10/16/2018 13:08	WG1180937
Iron	0.603		0.0282	0.100	1	10/16/2018 09:55	WG1180493
Iron,Dissolved	0.415		0.0282	0.100	1	10/16/2018 13:08	WG1180937
Lead	U		0.00200	0.00500	1	10/16/2018 09:55	WG1180493
Lead,Dissolved	U		0.00200	0.00500	1	10/16/2018 13:08	WG1180937
Manganese	0.0179		0.00200	0.0100	1	10/16/2018 09:55	WG1180493
Manganese,Dissolved	0.00983	J	0.00200	0.0100	1	10/16/2018 13:08	WG1180937
Nickel	U		0.00580	0.0100	1	10/16/2018 09:55	WG1180493
Nickel,Dissolved	U		0.00580	0.0100	1	10/16/2018 13:08	WG1180937
Selenium	U		0.00760	0.0100	1	10/16/2018 09:55	WG1180493
Selenium,Dissolved	U		0.00760	0.0100	1	10/16/2018 13:08	WG1180937
Silver	U		0.00270	0.00500	1	10/16/2018 09:55	WG1180493
Silver,Dissolved	U		0.00270	0.00500	1	10/16/2018 13:08	WG1180937
Zinc	0.00549	J	0.00340	0.0500	1	10/16/2018 09:55	WG1180493
Zinc,Dissolved	0.0129	J	0.00340	0.0500	1	10/16/2018 13:08	WG1180937

Wet Chemistry by Method 130.1

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Hardness (colorimetric) as CaCO3	20.3	B J	1.43	30.0	1	10/19/2018 11:02	WG1181776

Mercury by Method 245.1

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Mercury	U		0.0000490	0.000200	1	10/15/2018 09:26	WG1180786
Mercury,Dissolved	U		0.0000490	0.000200	1	10/16/2018 08:32	WG1181184

Metals (ICP) by Method 200.7

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Antimony	U		0.00770	0.0100	1	10/16/2018 09:07	WG1180493
Antimony,Dissolved	U		0.00770	0.0100	1	10/16/2018 12:34	WG1180937
Arsenic	U		0.00640	0.0100	1	10/16/2018 09:07	WG1180493
Arsenic,Dissolved	U		0.00640	0.0100	1	10/16/2018 12:34	WG1180937
Cadmium	U		0.000700	0.00200	1	10/16/2018 09:07	WG1180493
Cadmium,Dissolved	U		0.000700	0.00200	1	10/16/2018 12:34	WG1180937
Chromium	U		0.00180	0.0100	1	10/16/2018 09:07	WG1180493
Chromium,Dissolved	0.00184	J	0.00180	0.0100	1	10/16/2018 12:34	WG1180937
Copper	U		0.00700	0.0100	1	10/16/2018 09:07	WG1180493
Copper,Dissolved	0.0200		0.00700	0.0100	1	10/16/2018 12:34	WG1180937
Iron	0.646		0.0282	0.100	1	10/16/2018 09:07	WG1180493
Iron,Dissolved	0.464		0.0282	0.100	1	10/16/2018 12:34	WG1180937
Lead	U		0.00200	0.00500	1	10/16/2018 09:07	WG1180493
Lead,Dissolved	U		0.00200	0.00500	1	10/16/2018 12:34	WG1180937
Manganese	0.0243		0.00200	0.0100	1	10/16/2018 09:07	WG1180493
Manganese,Dissolved	0.0140		0.00200	0.0100	1	10/16/2018 12:34	WG1180937
Nickel	U		0.00580	0.0100	1	10/16/2018 09:07	WG1180493
Nickel,Dissolved	U		0.00580	0.0100	1	10/16/2018 12:34	WG1180937
Selenium	U		0.00760	0.0100	1	10/16/2018 09:07	WG1180493
Selenium,Dissolved	U		0.00760	0.0100	1	10/16/2018 12:34	WG1180937
Silver	U		0.00270	0.00500	1	10/16/2018 09:07	WG1180493
Silver,Dissolved	U		0.00270	0.00500	1	10/16/2018 12:34	WG1180937
Zinc	0.00525	J	0.00340	0.0500	1	10/16/2018 09:07	WG1180493
Zinc,Dissolved	0.00874	J	0.00340	0.0500	1	10/16/2018 12:34	WG1180937

Wet Chemistry by Method 130.1

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Hardness (colorimetric) as CaCO3	20.6	B J	1.43	30.0	1	10/19/2018 11:05	WG1181776

Mercury by Method 245.1

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Mercury	U		0.0000490	0.000200	1	10/15/2018 09:52	WG1180786
Mercury,Dissolved	U		0.0000490	0.000200	1	10/16/2018 08:44	WG1181184

Metals (ICP) by Method 200.7

Analyte	Result mg/l	Qualifier	MDL mg/l	RDL mg/l	Dilution	Analysis date / time	Batch
Antimony	U		0.00770	0.0100	1	10/16/2018 09:58	WG1180493
Antimony,Dissolved	U		0.00770	0.0100	1	10/16/2018 13:11	WG1180937
Arsenic	U		0.00640	0.0100	1	10/16/2018 09:58	WG1180493
Arsenic,Dissolved	0.00726	J	0.00640	0.0100	1	10/16/2018 13:11	WG1180937
Cadmium	U		0.000700	0.00200	1	10/16/2018 09:58	WG1180493
Cadmium,Dissolved	U		0.000700	0.00200	1	10/16/2018 13:11	WG1180937
Chromium	U		0.00180	0.0100	1	10/16/2018 09:58	WG1180493
Chromium,Dissolved	U		0.00180	0.0100	1	10/16/2018 13:11	WG1180937
Copper	U		0.00700	0.0100	1	10/16/2018 09:58	WG1180493
Copper,Dissolved	U		0.00700	0.0100	1	10/16/2018 13:11	WG1180937
Iron	0.615		0.0282	0.100	1	10/16/2018 09:58	WG1180493
Iron,Dissolved	0.461		0.0282	0.100	1	10/16/2018 13:11	WG1180937
Lead	U		0.00200	0.00500	1	10/16/2018 09:58	WG1180493
Lead,Dissolved	U		0.00200	0.00500	1	10/16/2018 13:11	WG1180937
Manganese	0.0174		0.00200	0.0100	1	10/16/2018 09:58	WG1180493
Manganese,Dissolved	0.0112		0.00200	0.0100	1	10/16/2018 13:11	WG1180937
Nickel	U		0.00580	0.0100	1	10/16/2018 09:58	WG1180493
Nickel,Dissolved	U		0.00580	0.0100	1	10/16/2018 13:11	WG1180937
Selenium	U		0.00760	0.0100	1	10/16/2018 09:58	WG1180493
Selenium,Dissolved	U		0.00760	0.0100	1	10/16/2018 13:11	WG1180937
Silver	U		0.00270	0.00500	1	10/16/2018 09:58	WG1180493
Silver,Dissolved	U		0.00270	0.00500	1	10/16/2018 13:11	WG1180937
Zinc	U		0.00340	0.0500	1	10/16/2018 09:58	WG1180493
Zinc,Dissolved	U		0.00340	0.0500	1	10/16/2018 13:11	WG1180937

Method Blank (MB)

(MB) R3352139-1 10/19/18 10:51

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Hardness (colorimetric) as CaCO3	6.69	J	1.43	30.0

L1034644-10 Original Sample (OS) • Duplicate (DUP)

(OS) L1034644-10 10/19/18 10:57 • (DUP) R3352139-4 10/19/18 10:58

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Hardness (colorimetric) as CaCO3	96.5	95.6	1	0.937		20

L1034975-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1034975-01 10/19/18 11:12 • (DUP) R3352139-7 10/19/18 11:13

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Hardness (colorimetric) as CaCO3	63.8	61.5	1	3.67		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3352139-2 10/19/18 10:52 • (LCSD) R3352139-3 10/19/18 10:53

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Hardness (colorimetric) as CaCO3	150	159	157	106	105	85.0-115			1.27	20

L1034679-15 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-15 10/19/18 11:02 • (MS) R3352139-5 10/19/18 11:03 • (MSD) R3352139-6 10/19/18 11:04

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Hardness (colorimetric) as CaCO3	150	20.3	170	171	99.8	100	1	80.0-120			0.587	20

Method Blank (MB)

(MB) R3350643-1 10/15/18 09:11

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Mercury	U		0.0000490	0.000200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3350643-2 10/15/18 09:13 • (LCSD) R3350643-3 10/15/18 09:16

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	0.00296	0.00290	98.6	96.6	85.0-115			2.01	20

L1034466-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034466-01 10/15/18 09:18 • (MS) R3350643-4 10/15/18 09:21 • (MSD) R3350643-5 10/15/18 09:23

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	U	0.00265	0.00297	88.3	99.1	1	70.0-130			11.6	20

L1034679-15 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-15 10/15/18 09:26 • (MS) R3350643-6 10/15/18 09:33 • (MSD) R3350643-7 10/15/18 09:35

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	U	0.00292	0.00267	97.2	89.0	1	70.0-130			8.78	20

Method Blank (MB)

(MB) R3350987-1 10/16/18 08:25

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Mercury,Dissolved	U		0.0000490	0.000200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3350987-2 10/16/18 08:27 • (LCSD) R3350987-3 10/16/18 08:30

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury,Dissolved	0.00300	0.00301	0.00272	100	90.7	85.0-115			10.1	20

L1034679-15 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-15 10/16/18 08:32 • (MS) R3350987-4 10/16/18 08:35 • (MSD) R3350987-5 10/16/18 08:37

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury,Dissolved	0.00300	U	0.00261	0.00261	87.1	87.1	1	70.0-130			0.107	20

Method Blank (MB)

(MB) R3351107-1 10/16/18 08:13

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Mercury	U		0.00280	0.0200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3351107-2 10/16/18 08:15 • (LCSD) R3351107-3 10/16/18 08:18

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury	0.300	0.254	0.256	84.7	85.2	80.0-120			0.573	20

L1034679-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-01 10/16/18 08:20 • (MS) R3351107-4 10/16/18 08:23 • (MSD) R3351107-5 10/16/18 08:25

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.300	0.0992	0.393	0.323	98.0	74.5	1	75.0-125		J6	19.6	20

L1034679-08 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-08 10/16/18 08:28 • (MS) R3351107-6 10/16/18 08:30 • (MSD) R3351107-7 10/16/18 08:33

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.300	U	0.216	0.247	71.9	82.3	1	75.0-125	J6		13.4	20

Method Blank (MB)

(MB) R3351038-1 10/16/18 08:33

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Antimony	U		0.00770	0.0100
Arsenic	U		0.00640	0.0100
Cadmium	U		0.000700	0.00200
Chromium	U		0.00180	0.0100
Copper	U		0.00700	0.0100
Iron	U		0.0282	0.100
Lead	U		0.00200	0.00500
Manganese	U		0.00200	0.0100
Nickel	U		0.00580	0.0100
Selenium	U		0.00760	0.0100
Silver	U		0.00270	0.00500
Zinc	U		0.00340	0.0500

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3351038-2 10/16/18 08:35 • (LCSD) R3351038-3 10/16/18 08:38

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Antimony	1.00	1.03	1.00	103	100	85.0-115			3.06	20
Arsenic	1.00	1.01	0.991	101	99.1	85.0-115			2.00	20
Cadmium	1.00	1.01	0.981	101	98.1	85.0-115			2.59	20
Chromium	1.00	0.993	0.965	99.3	96.5	85.0-115			2.91	20
Copper	1.00	1.01	0.985	101	98.5	85.0-115			2.68	20
Iron	10.0	10.0	9.70	100	97.0	85.0-115			3.49	20
Lead	1.00	1.01	0.988	101	98.8	85.0-115			2.60	20
Manganese	1.00	1.00	0.976	100	97.6	85.0-115			2.36	20
Nickel	1.00	1.02	0.994	102	99.4	85.0-115			2.93	20
Selenium	1.00	1.03	1.01	103	101	85.0-115			2.14	20
Silver	0.200	0.199	0.195	99.4	97.7	85.0-115			1.71	20
Zinc	1.00	1.00	0.976	100	97.6	85.0-115			2.63	20

L1034466-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034466-01 10/16/18 08:40 • (MS) R3351038-5 10/16/18 08:48 • (MSD) R3351038-6 10/16/18 08:51

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Antimony	1.00	U	1.05	1.04	105	104	1	70.0-130			0.917	20
Arsenic	1.00	52.6	53.6	53.6	102	105	1	70.0-130			0.0528	20
Cadmium	1.00	0.0383	1.04	1.03	100	99.6	1	70.0-130			0.595	20

L1034466-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034466-01 10/16/18 08:40 • (MS) R3351038-5 10/16/18 08:48 • (MSD) R3351038-6 10/16/18 08:51

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chromium	1.00	U	0.992	0.978	99.2	97.8	1	70.0-130			1.36	20
Copper	1.00	U	1.01	1.01	101	101	1	70.0-130			0.591	20
Iron	10.0	0.134	10.1	10.0	99.6	98.7	1	70.0-130			0.952	20
Lead	1.00	U	1.01	1.01	101	101	1	70.0-130			0.419	20
Manganese	1.00	0.00210	0.996	0.985	99.4	98.3	1	70.0-130			1.11	20
Nickel	1.00	0.0107	1.03	1.03	102	102	1	70.0-130			0.544	20
Selenium	1.00	U	1.03	1.03	103	103	1	70.0-130			0.734	20
Silver	0.200	U	0.199	0.197	99.6	98.6	1	70.0-130			0.929	20
Zinc	1.00	U	0.993	0.985	99.3	98.5	1	70.0-130			0.806	20

L1034475-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034475-01 10/16/18 08:54 • (MS) R3351038-7 10/16/18 08:56 • (MSD) R3351038-8 10/16/18 08:59

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Antimony	1.00	ND	1.02	1.01	102	101	1	70.0-130			0.334	20
Arsenic	1.00	ND	1.00	0.995	99.4	98.8	1	70.0-130			0.588	20
Cadmium	1.00	ND	0.987	0.980	98.7	98.0	1	70.0-130			0.756	20
Chromium	1.00	ND	0.983	0.969	98.3	96.9	1	70.0-130			1.47	20
Copper	1.00	ND	1.01	0.995	101	99.5	1	70.0-130			1.54	20
Iron	10.0	0.349	10.2	10.1	98.5	97.7	1	70.0-130			0.794	20
Lead	1.00	ND	0.999	0.987	99.9	98.7	1	70.0-130			1.23	20
Manganese	1.00	ND	0.997	0.983	99.4	97.9	1	70.0-130			1.50	20
Nickel	1.00	ND	1.01	0.999	101	99.9	1	70.0-130			0.995	20
Selenium	1.00	ND	1.01	1.00	101	100	1	70.0-130			0.681	20
Silver	0.200	ND	0.198	0.194	98.8	97.2	1	70.0-130			1.59	20
Zinc	1.00	ND	0.984	0.976	98.4	97.6	1	70.0-130			0.802	20

L1034679-15 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-15 10/16/18 09:07 • (MS) R3351038-9 10/16/18 09:09 • (MSD) R3351038-10 10/16/18 09:12

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Antimony	1.00	U	1.02	1.02	102	102	1	70.0-130			0.0386	20
Arsenic	1.00	U	1.03	1.02	103	102	1	70.0-130			0.720	20
Cadmium	1.00	U	1.01	1.00	101	100	1	70.0-130			0.880	20
Chromium	1.00	U	0.976	0.982	97.6	98.2	1	70.0-130			0.643	20
Copper	1.00	U	1.01	1.01	101	101	1	70.0-130			0.0549	20
Iron	10.0	0.646	10.5	10.5	98.5	98.2	1	70.0-130			0.211	20

L1034679-15 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-15 10/16/18 09:07 • (MS) R3351038-9 10/16/18 09:09 • (MSD) R3351038-10 10/16/18 09:12

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Lead	1.00	U	1.02	1.01	102	101	1	70.0-130			0.546	20
Manganese	1.00	0.0243	1.02	1.02	99.2	99.6	1	70.0-130			0.463	20
Nickel	1.00	U	1.03	1.02	103	102	1	70.0-130			0.556	20
Selenium	1.00	U	1.03	1.03	103	103	1	70.0-130			0.746	20
Silver	0.200	U	0.197	0.198	98.5	98.9	1	70.0-130			0.389	20
Zinc	1.00	0.00525	1.01	1.00	100	99.6	1	70.0-130			0.677	20

Method Blank (MB)

(MB) R3351199-1 10/16/18 12:27

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Antimony,Dissolved	U		0.00770	0.0100
Arsenic,Dissolved	U		0.00640	0.0100
Cadmium,Dissolved	U		0.000700	0.00200
Chromium,Dissolved	U		0.00180	0.0100
Copper,Dissolved	U		0.00700	0.0100
Iron,Dissolved	U		0.0282	0.100
Lead,Dissolved	U		0.00200	0.00500
Manganese,Dissolved	U		0.00200	0.0100
Nickel,Dissolved	U		0.00580	0.0100
Selenium,Dissolved	U		0.00760	0.0100
Silver,Dissolved	U		0.00270	0.00500
Zinc,Dissolved	U		0.00340	0.0500

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3351199-2 10/16/18 12:29 • (LCSD) R3351199-3 10/16/18 12:32

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Antimony,Dissolved	1.00	0.983	0.996	98.3	99.6	85.0-115			1.23	20
Arsenic,Dissolved	1.00	0.970	0.975	97.0	97.5	85.0-115			0.573	20
Cadmium,Dissolved	1.00	0.992	0.995	99.2	99.5	85.0-115			0.379	20
Chromium,Dissolved	1.00	0.989	0.994	98.9	99.4	85.0-115			0.432	20
Copper,Dissolved	1.00	0.988	0.999	98.8	99.9	85.0-115			1.07	20
Iron,Dissolved	10.0	9.99	10.0	99.9	100	85.0-115			0.154	20
Lead,Dissolved	1.00	0.984	0.992	98.4	99.2	85.0-115			0.744	20
Manganese,Dissolved	1.00	0.976	0.977	97.6	97.7	85.0-115			0.0443	20
Nickel,Dissolved	1.00	1.00	1.00	100	100	85.0-115			0.0984	20
Selenium,Dissolved	1.00	1.00	1.00	100	100	85.0-115			0.00109	20
Silver,Dissolved	0.200	0.188	0.189	93.9	94.4	85.0-115			0.534	20
Zinc,Dissolved	1.00	0.991	0.994	99.1	99.4	85.0-115			0.342	20

L1034679-15 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-15 10/16/18 12:34 • (MS) R3351199-5 10/16/18 12:39 • (MSD) R3351199-6 10/16/18 12:42

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Antimony,Dissolved	1.00	U	0.963	0.982	96.3	98.2	1	70.0-130			1.91	20
Arsenic,Dissolved	1.00	U	0.960	0.965	96.0	96.5	1	70.0-130			0.459	20
Cadmium,Dissolved	1.00	U	0.970	0.977	97.0	97.7	1	70.0-130			0.770	20

L1034679-15 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-15 10/16/18 12:34 • (MS) R3351199-5 10/16/18 12:39 • (MSD) R3351199-6 10/16/18 12:42

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chromium,Dissolved	1.00	0.00184	0.969	0.972	96.7	97.0	1	70.0-130			0.291	20
Copper,Dissolved	1.00	0.0200	0.997	1.01	97.7	98.7	1	70.0-130			1.06	20
Iron,Dissolved	10.0	0.464	10.2	10.3	97.3	98.6	1	70.0-130			1.24	20
Lead,Dissolved	1.00	U	0.971	0.974	97.1	97.4	1	70.0-130			0.301	20
Manganese,Dissolved	1.00	0.0140	0.963	0.966	94.9	95.2	1	70.0-130			0.290	20
Nickel,Dissolved	1.00	U	0.979	0.986	97.9	98.6	1	70.0-130			0.661	20
Selenium,Dissolved	1.00	U	0.974	0.989	97.4	98.9	1	70.0-130			1.53	20
Silver,Dissolved	0.200	U	0.184	0.184	91.8	91.9	1	70.0-130			0.0900	20
Zinc,Dissolved	1.00	0.00874	0.972	0.979	96.4	97.0	1	70.0-130			0.652	20

Method Blank (MB)

(MB) R3351034-1 10/16/18 09:22

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Antimony	U		0.750	2.00
Arsenic	U		0.460	2.00
Cadmium	U		0.0700	0.500
Chromium	U		0.140	1.00
Copper	U		0.530	2.00
Iron	U		1.41	10.0
Lead	U		0.190	0.500
Manganese	U		0.120	1.00
Nickel	U		0.490	2.00
Selenium	U		0.620	2.00
Silver	U		0.120	1.00
Zinc	U		0.590	5.00

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3351034-2 10/16/18 09:24 • (LCSD) R3351034-3 10/16/18 09:26

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Antimony	100	92.9	98.3	92.9	98.3	80.0-120			5.64	20
Arsenic	100	92.4	98.1	92.4	98.1	80.0-120			5.96	20
Cadmium	100	92.0	97.6	92.0	97.6	80.0-120			5.94	20
Chromium	100	96.1	102	96.1	102	80.0-120			6.32	20
Copper	100	95.5	102	95.5	102	80.0-120			6.48	20
Iron	1000	988	1050	98.8	105	80.0-120			6.52	20
Lead	100	94.1	99.7	94.1	99.7	80.0-120			5.78	20
Manganese	100	93.8	100	93.8	100	80.0-120			6.45	20
Nickel	100	95.5	102	95.5	102	80.0-120			6.55	20
Selenium	100	91.2	97.3	91.2	97.3	80.0-120			6.48	20
Silver	20.0	17.4	18.5	87.0	92.7	80.0-120			6.38	20
Zinc	100	93.2	99.2	93.2	99.2	80.0-120			6.19	20

L1034679-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-01 10/16/18 09:29 • (MS) R3351034-6 10/16/18 09:36 • (MSD) R3351034-7 10/16/18 09:38

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Antimony	100	5.96	60.1	45.9	54.1	40.0	1	75.0-125	J6	J3 J6	26.7	20
Arsenic	100	10.0	101	101	91.4	90.7	1	75.0-125			0.759	20
Cadmium	100	20.2	106	139	86.0	119	1	75.0-125		J3	26.6	20

L1034679-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-01 10/16/18 09:29 • (MS) R3351034-6 10/16/18 09:36 • (MSD) R3351034-7 10/16/18 09:38

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chromium	100	7.99	104	102	95.8	94.0	1	75.0-125			1.72	20
Copper	100	83.4	161	184	77.5	101	1	75.0-125			13.6	20
Iron	1000	15600	13300	17400	0.000	177	1	75.0-125	V	J3 V	27.0	20
Lead	100	932	718	834	0.000	0.000	1	75.0-125	V	V	14.9	20
Manganese	100	234	245	286	11.1	51.9	1	75.0-125	J6	J6	15.3	20
Nickel	100	5.06	106	105	101	99.8	1	75.0-125			1.37	20
Selenium	100	U	93.1	91.3	93.1	91.3	1	75.0-125			1.92	20
Silver	20.0	6.32	24.9	26.5	93.0	101	1	75.0-125			6.28	20
Zinc	100	1360	845	4040	0.000	2680	1	75.0-125	V	E J3 V	131	20

L1034679-08 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1034679-08 10/16/18 09:41 • (MS) R3351034-9 10/16/18 09:51 • (MSD) R3351034-10 10/16/18 09:53

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Antimony	100	U	81.9	78.7	81.9	78.7	1	75.0-125			4.03	20
Arsenic	100	U	94.7	94.0	94.7	94.0	1	75.0-125			0.691	20
Cadmium	100	0.118	95.6	94.5	95.5	94.4	1	75.0-125			1.19	20
Chromium	100	3.41	102	102	98.7	98.3	1	75.0-125			0.366	20
Copper	100	0.761	101	100	100	99.6	1	75.0-125			0.536	20
Iron	1000	3720	5430	5300	171	158	1	75.0-125	J5	J5	2.28	20
Lead	100	1.42	101	98.9	99.1	97.5	1	75.0-125			1.62	20
Manganese	100	213	348	333	135	120	1	75.0-125	J5		4.55	20
Nickel	100	2.11	104	102	101	99.8	1	75.0-125			1.60	20
Selenium	100	U	93.9	93.3	93.9	93.3	1	75.0-125			0.700	20
Silver	20.0	U	17.7	17.7	88.7	88.4	1	75.0-125			0.357	20
Zinc	100	16.2	115	113	99.1	97.3	1	75.0-125			1.58	20

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
B	The same analyte is found in the associated blank.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
J3	The associated batch QC was outside the established quality control range for precision.
J5	The sample matrix interfered with the ability to make any accurate determination; spike value is high.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
O1	The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.
V	The sample concentration is too high to evaluate accurate spike recoveries.

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T 104704245-17-14
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

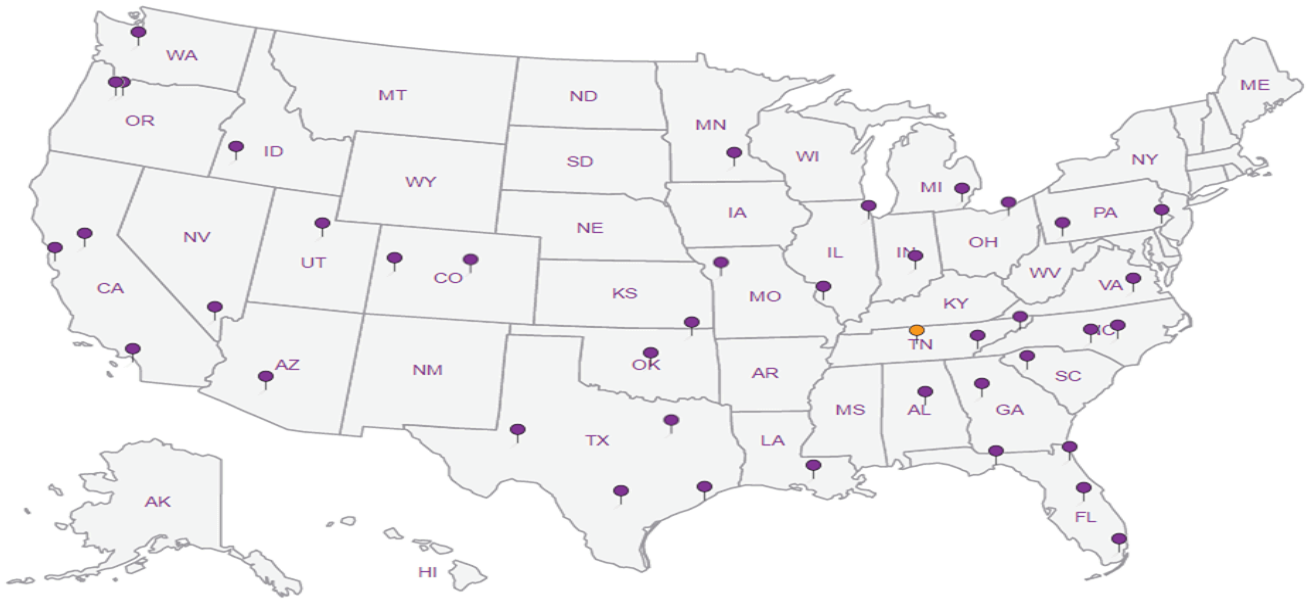
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



Applied Intellect

2801 Youngfield St., Ste 250
Golden, CO 80401

Billing Information: SAME

Report to: **John DeAngelis**

Email To: **john.deangelis@ap-in.com**

Project Description: Forest Hill Mill

City/State Collected: Gunnison County, CO

Phone: 303 246 8864
Fax:

Client Project #

Lab Project #

Collected by (print): John A. DeAngelis

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N X Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed: Normal T.O.

Pres Chk

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Metals* - 4oz Soil Jar	# Containers	Total Metals & Diss. Metals* - 250ml HDPE	Hardness - 250ml HDPE w/HN03	Remarks	Sample # (lab only)
~~FHU-~~												
FHM-FMU-SS-001	~~Comp~~ Grab	Soil	Surf	10-8-18	09:40	2	X	2			MS/MSD	-01
FHM-FML-SS-001	Comp	Soil	Surf	10-8-18	10:45	1	X	1				02
FHM-UWA1-SS-001	Comp	Soil	Surf.	10-8-18	12:20	1	X	1				03
FHM-UWA2-SS-001	Comp	Soil	Surf.	10-8-18	13:15	1	X	1				04
FHM-MTA2-SS-001	Comp	Soil	Surf.	10-8-18	14:35	1	X	1				05
FHM-LWA1-SS-001	Comp	Soil	Surf.	10-8-18	16:45	1	X	1				06
FHM-LWA2-SS-001	Comp	Soil	Surf.	10-9-18	08:30	1	X	1				07
FHM-TC-SD-001	Grab	SED	SED	10-9-18	12:30	1	X	1	8 oz		MS/MSD	08
FHM-TC-SD-002	Grab	SED	SED	10-9-18	11:05	1	X	1				09

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
Metals: Sb,As,Cd,Cr,Cu,Fe,Pb,Mn,Hg,Ni,Se,Ag,Zn

RAD SCREEN: <0.5 mR/hr pH _____ Temp _____ Flow _____ Other _____

Samples returned via: Hand Delivered
__ UPS __ FedEx __ Courier _____

Tracking # 4510 1655 0271

Chain of Custody Page ___ of ___

Pace Analytical
National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# L1034679

E243

Acctnum: APPINTGCO
Template:
Prelogin:
TSR:
PB:
Shipped Via:

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR	If preservation required by Login: Date/Time
	10-12-18	1013			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 3.2-0-3.2 °C Bottles Received: 23	
	10/12/18	1730			
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 10/13/18 Time: 8:45	Hold: Condition: NCF / OK
			SCI		

Applied Intellect

2801 Youngfield St., Ste 250
Golden, CO 80401

Billing Information: SAME

Report to: **John DeAngelis**

Email To: **john.deangelis@ap-in.com**

Project Description: Forest Hill Mill

City/State Collected: Gunnison County, CO

Phone: 303 246-8864
Fax:

Client Project #

Lab Project #

Collected by (print): John A. DeAngelis

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N X Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed: Normal T.O.

Pres Chk

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Metals* - 4oz Soil Jar		Total Metals & Diss. Metals* - 250ml HDPE	Hardness - 250ml HDPE w/HN03						Remarks	Sample # (lab only)
FHM-TC-SD-003	Grab	SED	SED	~~10-9-18~~ 10-9-18	10:00	1	X										-16
FHM-UA-SS-001	Comp	Soil	Surf.	10-8-18	12:00	1	X										11
FHM-TC-SD-004	Grab	SED	SED	10-9-18	12:05	1	X										12
FHM-TC-SW-001	Grab	SW	NA	10-9-18	12:25	2			X	X							13
FHM-TC-SW-002	Grab	SW	NA	10-9-18	11:00	2			X	X							14
FHM-TC-SW-003	Grab	SW	NA	10-9-18	10:00	4			X	X						MS/MSD	15
FHM-TC-SW-004	Grab	SW	NA	10-9-18	12:00	2			X	X							16

Chain of Custody Page ___ of ___

Pace Analytical™
National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# L1034679

Table #

Acctnum: **APPINTGCO**

Template:

Prelogin:

TSR:

PB:

Shipped Via:

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
Metals: Sb,As,Cd,Cr,Cu,Fe,Pb,Mn,Hg,Ni,Se,Ag,Zn

Samples returned via: Hand Delivered
__ UPS __ FedEx __ Courier ____

Tracking #

pH _____ Temp _____
Flow _____ Other _____

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
	10-12-18	1013	
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
	10/12/18	1730	
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)
			SGL

Trip Blank Received: Yes / (No)
HCL / MeoH
TBR

Temp: 3.2+0.3=3.5 °C Bottles Received: 23

Date: 10/13/18 Time: 8:45

If preservation required by Login: Date/Time

Hold:

Condition: NCF / (OK)

Appendix E
Laboratory Data Validation Review

Appendix E: Laboratory Data Validation Review

E.1: Soil and Sediment Results - Metals

Pace analyzed the soil and sediment samples for metals analyses by Inductively Coupled Plasma (ICP) United States Environmental Protection Agency (USEPA) Method 6010B and ICP-Mass Spectrometry (ICP-MS) USEPA Method 6020 for antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, silver, and zinc. Mercury was analyzed using USEPA Method 7471A.

Results from Pace were provided in a single laboratory data package Analytical Report for Sample Delivery Group (SDG) L1034679, dated October 22, 2018 (see Appendix A). Results from Pace are to be used to estimate health-based risk to human health and ecological receptors and are quantitative in nature and requirement.

The case narrative indicated that all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all Method Detection Limit (MDL) and Reported Detection Limit (RDL) values reported for environmental samples were corrected for the dilution factor used in the analysis. All Method and Batch Quality Control were within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results.

Matrix interference was noted in the soil and sediment MS/MSD laboratory quality assurance/quality control (QA/QC) samples, noted in the qualified results for the following samples and analytes:

- FHM-FMU-SS-001 (antimony, cadmium, copper, iron, lead, manganese, and zinc); and
- FHM-TC-SD-001 (iron and manganese)

However, the results of the Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCD) for soil and sediment ranged from 5.64 to 6.52 percent (%) for the soil MS/MSD, and 0.357% to 4.55% for the sediment MS/MSD, which are all within the 20% Relative Percent Difference (RPD) control limits.
No other soil and sediment sample results were qualified in this SDG, except for reported estimated values (J-qualified) for trace levels slightly above the MDL for the following:

- FHM-FML-SS-001 (Nickel and selenium);
- FHM-UWA1-SS-001 (Nickel);
- FHM-LWA2-SSS-001 (Selenium);
- FHM-TC-SD-001 (Cadmium and Chromium);
- FHM-TC-SD-002 (Copper); and
- FHM-TC-SD-003 (Cadmium, copper and nickel).

Field Duplicate Samples – Soil and Sediment

Sample ID's for soil and sediment field duplicate samples are listed below:

- Soil sample FHM-MTA2-SS-001 and field duplicate FHM-UA-SS-001
- Sediment sample FHM-TC-SD-002 and field duplicate FHM-TC-SD-004

The Relative Percent Difference (RPD) for comparison of the normal sample concentrations with the duplicate sample concentrations were calculated using the following formula:

% RPD = (sample result - duplicate result) X 100 ÷ (sample result + duplicate result)/2

For soil samples FHM-MTA2-SS-001 and field duplicate FHM-UA-SS-001, RPDs ranged from 1.5 to 18% for all metals analytes, which represents excellent correlation for soil. RPDs less than 30% for soil are considered highly correlative because of inherent heterogeneity in soil matrices.

The sediment samples FHM-TC-SD-002 and field duplicate FHM-TC-SD-004 indicated RPDs ranging from 9 to 42%. It should be noted that the metals in sediment were non-detect for antimony, arsenic, selenium, and silver; also the detections of the remaining metals in sediment were comparable or slightly above the background sediment sample, as indicated in the main text. RPDs for sediment would not be expected to be highly correlative with these low concentrations.

E.2 Water Results - Metals

The water samples were analyzed for metals analyses by ICP USEPA Method 200.7 for antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, silver, and zinc. Mercury was analyzed using USEPA Method 245.1.

Results from Pace were provided in a single laboratory data package Analytical Report for Sample Delivery Group (SDG) L1034679, dated October 22, 2018 (see Appendix A). Results from Pace are to be used to estimate health-based risk to human health and ecological receptors and are quantitative in nature and requirement.

The case narrative indicated that all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL and RDL values reported for environmental samples were corrected for the dilution factor used in the analysis. All Method and Batch Quality Control were within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results.

The case narrative indicated no qualified results for the water samples collected from Trail Creek, except for J-qualified reported estimated values for trace levels slightly above the MDL for the following:

- FHM-TC-SW-001 (Dissolved zinc);
- FHM-TC-SW-002 (Dissolved manganese, and total and dissolved zinc); and
- FHM-TC-SW-003 (Dissolved chromium, and total and dissolved zinc).

Field Duplicate Sample – Water

Sample ID's for water field duplicate samples are listed below:

- Water sample FHM-TC-SW-002 and field duplicate FHM-TC-SW-004

All metals results for these samples were at concentrations below the method detection limits. Therefore, RPD calculations were not completed for the water samples.

E.3 Soil Results – ABA

ACZ analyzed the composite soil samples for ABA, including paste pH by USEPA Method 600/2-78-054. Results from ACZ were provided in a single laboratory data package Analytical Report for Sample Delivery Group (SDG) L47579, dated December 5, 2018 (see Appendix B).

The case narrative indicated that ACZ received seven samples from AI on October 15, 2018. The samples were received in good condition. Upon receipt, the sample custodian removed the samples from the cooler, inspected the contents, and logged the samples into ACZ's computerized Laboratory Information Management System (LIMS). The samples were assigned ACZ LIMS project number L47579. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels. All analyses were performed within USEPA recommended holding times.

Several reported analytical results for ABA were qualified with a "B", indicating that the analyte concentration was detected at a value between the MDL and the Practical Quantitation Limit (PQL), and therefore the reported value was estimated. The ABA screening is used to evaluate the potential for acid generation. All sample results from ACZ are for fate and transport evaluation and will not be used for risk assessment; therefore, they are semi-quantitative in requirement, and the estimated values are deemed appropriate for purposes of site characterization.

E.4 Nutrient Analyses

Soil nutrient analyses were completed to evaluate potential reclamation/revegetation and soil amendments. The raw lab data are of sufficient quality for these purposes.

Appendix F

Threatened and Endangered Species Review Information for Planning and Consultation (IPaC)
US Fish and Wildlife Service

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Gunnison County, Colorado

Local office

Western Colorado Ecological Services Field Office

(970) 243-2778
(970) 245-6933

445 West Gunnison Avenue, Suite 240
Grand Junction, CO 81501-5711

http://www.fws.gov/mountain-prairie/es/Colorado/
http://www.fws.gov/platteriver/

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS

Canada Lynx Lynx canadensis — Threatened

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/3652

North American Wolverine Gulo gulo luscus — Proposed Threatened

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5123

Birds

NAME	STATUS

Gunnison Sage-grouse Centrocercus minimus — Threatened

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/6040

Fishes

NAME	STATUS

Bonytail Chub Gila elegans — Endangered

This species only needs to be considered if the following condition applies:

- Water depletions in the upper Colorado River basin adversely affect this species and its critical habitat. This species does not need to be considered if the project is outside of its occupied habitat and does not deplete water from the basin.

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/1377

Colorado Pikeminnow (=squawfish) Ptychocheilus lucius — Endangered

This species only needs to be considered if the following condition applies:

- Water depletions in the upper Colorado River basin adversely affect this species and its critical habitat. This species does not need to be considered if the project is outside of its occupied habitat and does not deplete water from the basin.

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/3531

Greenback Cutthroat Trout Oncorhynchus clarkii stomias — Threatened

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2775

Humpback Chub Gila cypha — Endangered

This species only needs to be considered if the following condition applies:

- Water depletions in the upper Colorado River basin adversely affect this species and its critical habitat. This species does not need to be considered if the project is outside of its occupied habitat and does not deplete water from the basin.

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/3930

Razorback Sucker Xyrauchen texanus — Endangered

This species only needs to be considered if the following condition applies:

- Water depletions in the upper Colorado River basin adversely affect this species and its critical habitat. This species does not need to be considered if the project is outside of its occupied habitat and does not deplete water from the basin.

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/530

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php

- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Rufous Hummingbird selasphorus rufus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8002	Breeds elsewhere

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ “Proper Interpretation and Use of Your Migratory Bird Report” before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

■ probability of presence ■ breeding season | survey effort – no data

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

Rufous Hummingbird
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the E-bird Explore Data Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ “What does IPaC use to generate the migratory birds potentially occurring in my specified location”. Please be aware this report provides the “probability of presence” of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the “no data” indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ “Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds” at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

WETLAND INFORMATION IS NOT AVAILABLE AT THIS TIME

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters.

Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Appendix G

BLM Technical Memorandum: Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

United States Bureau of Land Management, September 2017 Update

BLM Technical Memorandum

Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

September 2017 Update: Table 1 has been updated to reflect EPA's latest Regional Screening Level summary table values and toxicity updates (June 2017). The only metal whose screening levels changed from the previous version of this memorandum is uranium, which decreased an order of magnitude due to a new oral toxicity value recommended by EPA.

Introduction: The screening of chemicals present at a site constitutes the first phase of the assessment of human health and environmental risk. This paper discusses strategies and considerations for conducting a screening assessment, and describes a "multiple lines of evidence" approach to support site decision making.

At most BLM HazMat/AML sites, inorganics (metals and metalloids) are the primary concern, but many of the approaches in this document also applies to organic compounds. A screening level assessment typically consists of a comparison of site data with a risk-based concentration to evaluate whether a release has occurred and to get an initial understanding of the potential risks. Screening levels (SLs) are concentrations of chemicals in soil intended to be protective of human health and/or the environment under a defined exposure setting. SLs can be developed for all media, but are most commonly used at sites with soil contamination (or tailings). By their nature SLs are conservative (i.e., health protective) since they are acting in lieu of information gathered during a more detailed site investigation. Considerations for the development of SLs should include land use and habitat at the site, the presence and activities of human and ecological receptors, possible contaminant migration, and naturally occurring background concentrations. As a general rule, SLs are generic and do not take into account site-specific issues.

SLs are often used in the early phases of an environmental investigation program when only minimal data is available – for example, during the Preliminary Assessment and Site Inspection (PA/SI) phase. Data collected during more comprehensive site assessments, such as an Environmental Evaluation and Cost Analysis (EE/CA) or Remedial Investigation and Feasibility Study (RI/FS), may also be compared with SLs as part of a site-specific risk assessment. The data considered in a PA/SI screening assessment should include samples collected from site locations considered to be the most contaminated. The maximum detected chemical concentrations (max detects) may then be compared with SLs to get an initial understanding of the degree of potential risk present at the site. The approach of comparing max detects with conservative SLs tends to provide a worst-case portrait of potential risk. This worst-case evaluation tends to overestimate true risks and should be interpreted cautiously and in conjunction with the other site factors discussed in this memo.

Screening Basics: There are a number of assumptions inherent in SLs that need to be considered before conducting a site screening. In brief, the specific populations and receptors of interest, the primary pathways, and chemical toxicity all affect the appropriateness of an SL. For example, human health SLs can be developed for residents, workers, or recreational visitors, and may consider either cancer or noncancer endpoints. Alternatively, ecological SLs may be developed for soil dwelling organisms (e.g., invertebrates, small mammals), vegetation, birds, or herbivores. In general, SLs tend to be most appropriate for long-term, chronic exposure scenarios. In many cases at BLM sites, human exposures tend to be more occasional and short-term (e.g., a recreational hiker). Casual use of SLs should not replace an understanding of site setting and the development of a conceptual site model (CSM) that links chemical sources to potentially exposed receptors.

The results of a risk-based screening are typically presented as the ratio of the site concentration of a specific chemical to its respective health-protective screening value. This may be referred to as a numerical or quantitative screen. When the ratio (the “hazard quotient”, or HQ, in risk assessment terms) exceeds one (1), that chemical is considered to pose a potential risk and should be evaluated further. If the max detect for a chemical is below its SL, it is often concluded that this chemical does not pose a risk and may be dropped from future consideration. Examples of widely used screening levels for chemicals in soil are presented in Table 1.

Screening can be made on a chemical-by-chemical as well as a media-specific basis. Most commonly, the max detect of a specific chemical is compared against a screening value for that same chemical. If the max detect is less than the SL, often it is concluded the chemical doesn’t pose a risk and is not considered further. If the max detect for all chemicals are below their respective SLs, it is often concluded that the site soil doesn’t pose a significant risk. Chemicals that exceed their respective SLs are termed “chemicals of potential concern” (COPCs) and it is generally considered that further action (i.e., more comprehensive investigation) is needed. If exceedances are substantial and the CSM suggests the exposures are ongoing, an emergency or time-critical removal action may be appropriate. More typically, however, additional data is collected to further evaluate how extensive the contamination and potential risk is before any remedial action is taken. It should be kept in mind that mine tailings and waste rock are not soil, although they are commonly evaluated as such in screening level assessments. Their physical and chemical attributes are different than actual soil, which may affect some risk assessment assumptions (e.g., bioavailability, which represents the amount of chemical actually absorbed into the bloodstream). The ecological habitat provided by tailings and waste rock may be of minimal value, since tailings are mostly devoid of nutrients and organic matter. As a general rule, it is not recommended that ecological SLs developed for soil be applied to tailings and waste.

Although screening level assessments are commonly mentioned in regulatory documents, there is not much available in the way of formal guidance. EPA’s PA/SI, EE/CA, and RI/FS and Risk Assessment Guidance for Superfund (RAGS) should be reviewed if additional information is needed. In addition, some states have SLs available as guidance or written into regulation.

Background Concentrations: Screening against naturally occurring background concentrations is an important step at most AML sites. Background concentrations can vary significantly between locations, particularly in mineralized zones where mining is typically done. A background screen provides a different perspective from a risk-based screen; depending on the site setting and the chemical, the background concentration can be higher or lower than a risk-based screening value. Typically both a risk-based and a background screening comparison are conducted to determine which chemicals pose a potential risk above and beyond naturally occurring concentrations. A site may exceed risk-based SLs yet be below background levels; this should be taken into consideration when evaluating a screening assessment.

Table 2 presents a summary of representative background concentrations of naturally occurring metals in soil throughout the western US. These concentrations may not describe mineralized zones, however, and should only be used if site-specific values are not available. The data in Table 2 are provided as a general reference but are not meant to replace site-specific values. Background values are best used in combination with SLs to evaluate whether a release of hazardous substances has occurred at the site.

Using Screening Results: Screening level evaluations should be interpreted cautiously when making site management decisions. Screening assessments are usually based on limited site data; making informed decisions often requires that additional data be collected to better define the problem. It can be tempting to conduct a "quick and dirty" comparison of some data and conclude that the site does or doesn't pose an unacceptable risk. It should be noted that a screening level evaluation is only as useful as the site data (e.g., has a sample [or samples] been collected from the area of expected highest concentration?) and the appropriateness of the SL (e.g., a human health SL doesn't inform as to ecological risk). Screening levels are NOT default cleanup levels, and site decisions should not be based solely on exceedances of these levels.

The proper way to interpret a screening level assessment is by combining an understanding of possible human health risk, ecological habitat and exposure potential, site characteristics, contaminant migration potential, and background levels. An important initial step is developing a CSM, usually represented as a diagram that links contaminant source areas to human and ecological receptors via exposure and transport pathways (Figure 1).

Human Health Screening

The most widely used human health screening values are the Regional Screening Level (RSLs) developed by the US EPA for residential and industrial populations (http://www.epa.gov/region9/superfund/prg/). These values are very conservative (e.g., overly protective) for most BLM sites, since they assume more frequent and routine site exposure than typically occurs on BLM land. For example, the residential RSLs assume exposure to site soil for 350 days/year for 26 years and the industrial RSLs assume worker exposure for 225 days/year for 25 years. Although highly conservative for most BLM sites, EPA's RSLs can be useful in gaining an initial understanding of the magnitude of potential risk and at sites where off-site residents live in immediate proximity of the contamination. In addition to soil, EPA has developed RSLs for air, tapwater, and protection of groundwater. Some state health agencies

have also developed screening levels, but like EPA they only address residents and workers. EPA SLs for residential and industrial exposure are shown in Table 1.

Recreational visitors are the most common group of human receptors on BLM land. This is a broad category that can cover a range of possible activities, including camping, hiking, hunting, biking, ATV riding, horseback riding, etc., all with somewhat different exposure profiles. An example CSM for recreational visitor land use is shown in Figure 1. Most BLM land has no formal use or access restrictions, so conservative, yet realistic, assumptions must be made regarding the frequency of recreational use. BLM has developed a set of recreational SLs for metals most commonly found at AML sites. BLM's recreational SLs (Table 1) take into account the limited exposures associated with most recreational activities. The yearly recreational exposure frequency is assumed to be14 days/year, based on the assumption that individuals are unlikely to spend more time at an individual site on an annual basis. The exposure duration assumed for recreational visitors, 26 years, is the default exposure duration recommended by EPA for residents. It has been assumed that two years of the exposure occur as a child and 24 years as an adult; appropriate exposure parameters have been included in the calculations to account for these integrated age groups. The recreational RSLs were calculated using EPA's online screening level calculator. BLM will update the values in Table 1 periodically based on EPA's updates of toxicity values and exposure assumptions.

Ecological Screening

Terrestrial Receptors: A numerical ecological screening evaluation is not typically done in the initial phase of an environmental investigation. It is important to first identify habitat types present, possible receptors, and whether threatened or endangered (T&E) species may be present. This can be done through an investigation of site history and a literature search, and should be incorporated into the CSM. At most BLM mine sites, the ecological screening step will be more dependent on various qualitative endpoints, such as habitat, availability of food and shelter, and general ecological "attractiveness" of the site (such as proximity to waterways). Many BLM AML sites consist of tailings or waste rock piles, and provide little or no functional habitat to ecological receptors.

Ecological SLs for chemicals in soil for different receptors are available from EPA, US Fish and Wildlife, and other groups. These levels have many assumptions built into them, and should be considered only when the initial qualitative screening step indicates that that may be potentially significant exposures to sensitive receptors at the site. EPA ecological risk guidance notes a difference between potential impacts to individual organisms and population groups. An ecological screen at BLM mine sites needs to consider how widespread the site effects may be; impacts to receptors (real or calculated) assumed to be directly exposed to the site need to be considered in light of impacts to the local or regional population. In broad terms, common receptors are protected at the population level, while T&E species are protected at the individual organism level.

Conducting a quantitative ecological risk assessment (e.g., a "baseline" risk assessment) remains an option, should the screening step raise concerns over possible ecological risk. The ecological protective levels mentioned previously would be considered as part of a site-specific

risk assessment. This level of detail is only needed at a relatively small proportion of BLM HazMat/AML sites.

Aquatic Receptors: Some BLM mine sites directly impact aquatic habitat by draining into nearby wetlands, streams, or rivers. Tailings may have been dumped directly into waterways, may be slowing migrating over time, or acid mine drainage may be coming from an adit. Both contaminated surface water and sediments can adversely affect aquatic receptors, which are sensitive to the toxic effects of some metals. Sites that impact wetlands and waterways are generally of greater concern, due to potential widespread impact and the high toxicity of many metals to aquatic life.

Not all waterways run year round; many of the smaller streams near mine sites on BLM lands in the Western US are ephemeral in nature and are dry part of the year. This obviously limits the types of receptors that may be present. The CSM should determine whether aquatic or wetlands species need to be considered. Depending on the flow volume and regularity, ambient water quality criteria (AWQC) may be identified as "applicable or relevant and appropriate requirements", or ARARs.

Developing a "Multiple Lines of Evidence" Discussion for a Screening Assessment

A screening assessment should not be considered as a single step, rather it should assemble multiple lines of evidence that provide a more complete picture of contamination and risk at a site. Although every site has its unique characteristics, typically a screening analysis should consider the following factors as part of a multiple lines of evidence evaluation.

- Site characteristics: Location, proximity and access issues, historical activities
- Attractive nuisances: holes and adits, old equipment
- Contamination: distribution, concentration, types of chemicals, speciation
- Human health: signs of use, types of likely or possible use, numerical screening results
- Ecological: habitat types, presence of water, size of site, receptors, T&E species
- Groundwater and surface water: hydraulic connections, transport, leachability
- Background concentrations: mineralized zone vs. standard locations
- Offsite migration potential:

Figure 2 shows a schematic representation of how multiple lines of evidence may be combined to support decision making. It is not a fixed process with mandatory inputs; rather it is a flexible approach that combines a variety of relevant site information into an overall matrix that can provide the basis for informed decision making. The weighting of each line of evidence will vary depending on the quality and importance of the data. As the lines of evidence are developed, there are opportunities to collect additional information as project uncertainties are identified.

Taken collectively, the overall weight of evidence should allow the project manager to conclude whether the site is not likely to pose any risk or whether potential risk is present and the site should be evaluated further. The lines of evidence and their findings should be presented in the PA/SI (or other document) and used to support the overall conclusions of the investigation and help chart the path forward.

After the Screening Assessment

Screening assessments are most commonly used to evaluate sites and determine if they clearly pose minimal or no risk, may pose a potential risk, and those that clearly exceed acceptable risk levels. Future site activities may be developed based on the findings of the screening assessments. Sites with minimal risk may be candidates for a "no further action" determination; sites with potential risk may require a modest amount of additional information be collected to support decision making; and sites with high risk may be candidates for an EE/CA, an RI/FS, or more extensive intervention.

Initial site COPCs are typically identified in the screening assessment and may require further consideration. The lines of evidence discussion will help identify areas of uncertainty and data gaps that need to be addressed. Finally, screening levels may be useful as preliminary remediation goals, but should not automatically be considered as default cleanup values.

For additional information on screening assessments and risk assessments, please contact Doug Cox at the National Operations Center at dcox@blm.gov or 303-236-9451.

Table 1
Human Health Screening Levels (SLs) for Chemicals in Soil At BLM HazMat/AML Sites (mg/kg)

Chemical	BLM Recreational SL	EPA Residential SL	EPA Industrial SL
Aluminum (Al)	>1,000,000	77,000	>1,000,000
Antimony (Sb)	782	31	470
Arsenic (As)	30.6	0.68	3
Barium (Ba)	390,000	15,000	220,000
Beryllium (Be)	3,910	160	2,300
Cadmium (Cd)	1,780	71	980
Chromium (III) (Cr)	>1,000,000	120,000	>1,000,000
Cobalt (Co)	586	23	350
Copper (Cu)	78,200	3,100	47,000
Iron (Fe)	>1,000,000	55,000	820,000
Lead (Pb)	800[a]	400	800
Manganese (Mn)	46,700	1,800	26,000
Mercury (elemental) (Hg)[b]	271	11	46
Molybdenum (Mo)	9,780	390	5,800
Nickel (Ni)	39,000	1,500	22,000
Selenium (Se)	9,780	390	5,800
Silver (Ag)	9,780	390	5,800
Thallium (Tl)	19.6	0.78	12
Uranium (U)[c]	391	16	230
Vanadium (V)	9,850	390	5,800
Zinc (Zn)	587,000	23,000	350,000
Primary Exposure Assumptions	14 days/year, 26 years, adult/child	350 days/year, 26 years, adult/child	225 days/year, 25 years, adult

[a]The recreational SL for lead is based on EPA's industrial SL, which assumes regular and chronic exposure to soil, although not as frequently or extensively as the residential SL.

[b]Mercury is the only metal on the list whose SL is based on the inhalation pathway. EPA made some minor changes in their volatilization modeling in 2015 and the SL increased slightly. SLs for all populations may exceed the soil saturation concentration (Csat), an estimate of the concentration at which the soil pore water, pore air, and surface sorption sites are saturated. Above this theoretical threshold concentration, mercury may be present in free-phase within the soil matrix.

[c]Uranium screening values updated per changes in EPA's oral toxicity value.

Table 2
Representative Background Concentrations of Metals In Soils of the Western US (mg/kg)[a]

Chemical	Typical (Average)	High End (Maximum)
Aluminum (Al)	5,800	100,000
Antimony (Sb)	0.62	2.6
Arsenic (As)	7	97
Barium (Ba)	670	5,000
Beryllium (Be)	0.97	15
Cadmium (Ca)	< 1.0	11
Chromium (III) (Cr)	56	2000
Cobalt (Co)	9	50
Copper (Cu)	27	300
Iron (Fe)	26,000	> 100,000
Lead (Pb)	20	700
Manganese (Mn)	480	5,000
Mercury (Hg) (elemental)	0.065	4.6
Molybdenum (Mo)	1.1	7
Nickel (Ni)	19	700
Selenium (Se)	0.34	4.3
Silver (Ag)	0.5	5
Thallium (Tl)	9.8	31
Uranium (U)	2.7	7.9
Vanadium (V)	88	500
Zinc (Zn)	65	2,100

[a] Values are indicative of the range of naturally occurring soil concentrations in the western United States. Variations can occur from site to site. Concentrations in local mineralized zones may not be included.

Source: Elements in North American Soils, 2nd Ed. 2005.

Figure 1
Example of a Human Health Conceptual Site Model (CSM)

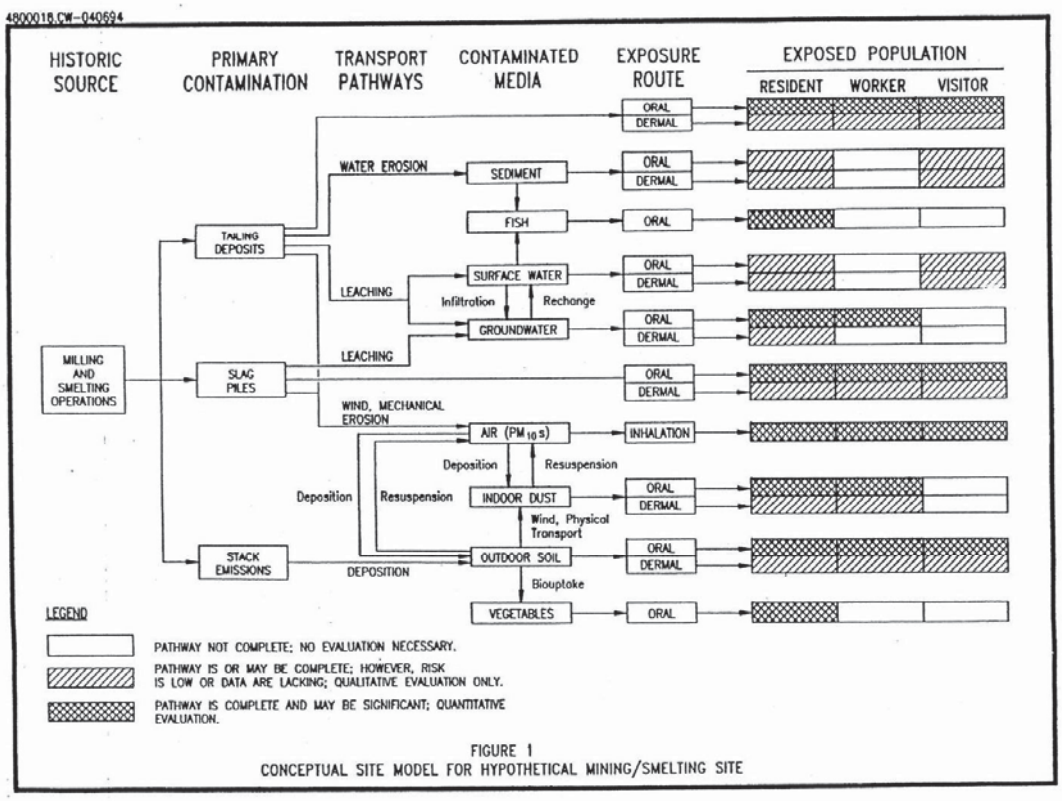
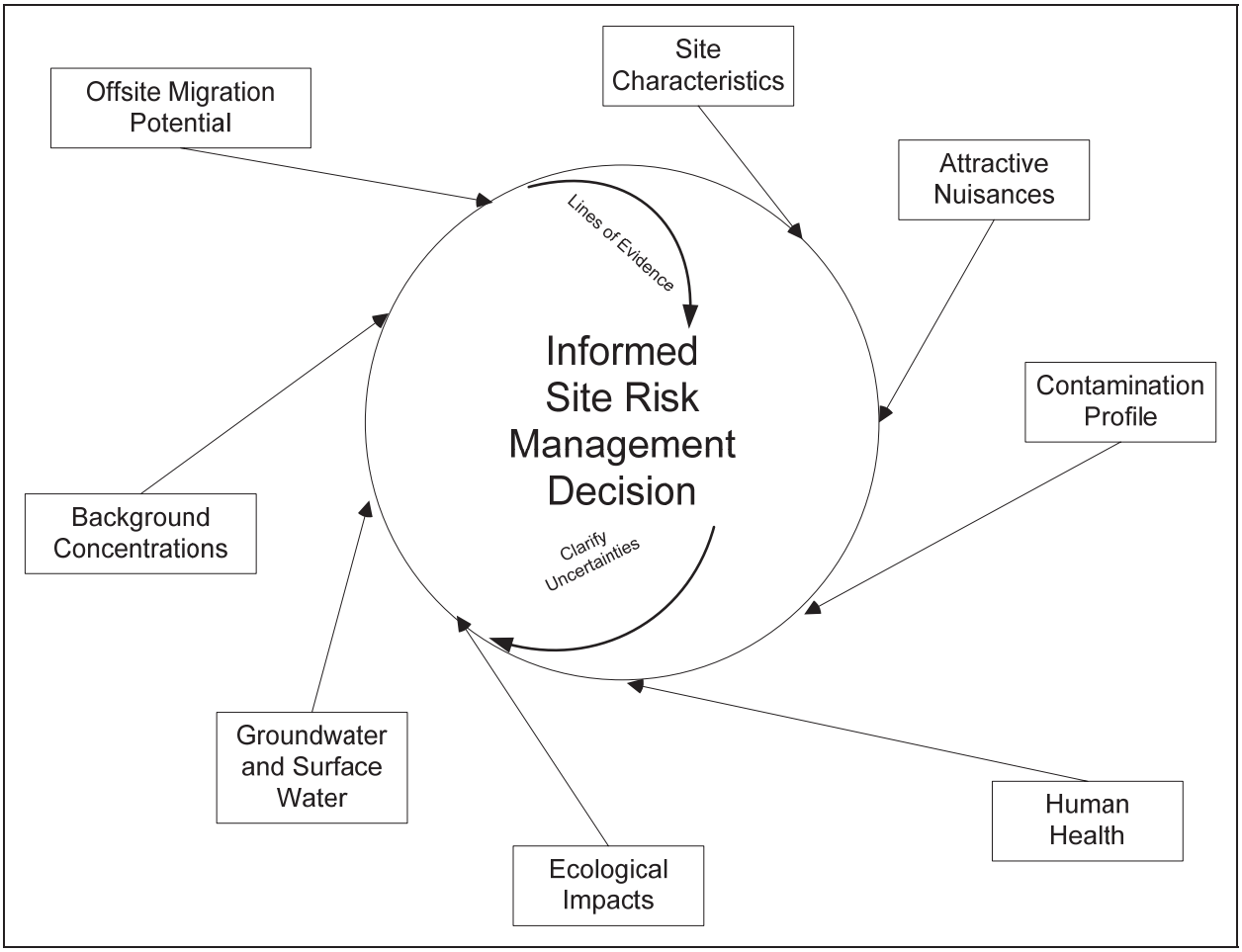


FIGURE 1
CONCEPTUAL SITE MODEL FOR HYPOTHETICAL MINING/SMELTING SITE

Figure 2
Using Multiple Lines of Evidence to Support a Screening Assessment



Appendix H

Photo-Documentation, October 8 through 11, 2018 Forest Hill EE/CA Field Investigation
Applied Intellect, LLC

Upper Mill Area

Lower Mill Area

Trail Creek Adjacent to Lower Mill Area

Tailings (> 6 -inches) at Test Pit – Main Tailings Area 1

Surface Tailings (< 1-inch) – Main Tailings Area 2

Surficial Tailings (1- to 2-inch) - Upper Washout Area 1

Upper Washout Area 2 – No Obvious Tailings

Upper Washout Area 2

Lower Washout Areas – Thin Veneer of Tailings

Potential Repository Location Soil from Test Pit

Appendix I

Responsiveness Summary

Forest Hill EE/CA Response to Public Comments

Public Comment Period – November 12, 2019 through December 12, 2019

Applied Intellect, LLC

Responsiveness Summary
Forest Hill Mill and Tailings Washout EE/CA
Public Comment Period – November 12, 2019 through December 12, 2019

1. INTRODUCTION

The US Forest Service (USFS) Grand, Mesa, Uncompahgre, and Gunnison (GMUG) National Forest (NF) solicited comments on the Draft Final Forest Hill Mill and Tailings Outwash Engineering Evaluation/Cost Analysis (Applied Intellect LLC [AI], 2019) during a public comment period that began on November 12, 2019 and ended on December 12, 2019. The USFS GMUG NF received no written comments during the public comment period. The USFS GMUG NF also held a public meeting on November 21, 2019, in which the USFS discussed the proposed removal action. The USFS received three public comments at that meeting.

1.1 Community Involvement Background

It is the intent of USFS that the citizens of Colorado have the opportunity to be actively involved in the USFS decision-making process with respect to USFS Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sites. The Forest Hill Mill and Tailings Outwash Site is being addressed as a non-time critical removal action site via CERCLA, with the USFS as the Lead Federal agency.

1.2 Notification of Public Comment Period

Printed notices of availability were published in the Gunnison Country Time weekly newspaper, a press release was provided to the news media from the USFS GMUG office of Public Affairs, and the Final Draft technical report was provided for public review on the USFS GMUG NF website for review.

1.3 Explanation of Responsiveness Summary

All comments received during the public comment period on the EE/CA have been reviewed and considered by USFS in the decision-making process and are addressed in this Responsiveness Summary. To assist in developing responses, DEQ added its own numbering to comments where appropriate to add clarity. Each specific verbal comment is paraphrased based on notes recorded at the Public Meeting on November 21, 2019.

Comment 1. What routes will the USFS use to transport tailings from current areas of concern to the onsite repositories, considering the work will likely be conducted during busy visitor season at Taylor Park? The USFS should consider a possible route that bypasses the main road (County Road 748), to avoid traffic.

Response 1: In the removal action design phase of the CERCLA process, the USFS will consider National Forest visitors when determining routes for heavy equipment and truck traffic.

Comment 2: Will the removal of tailings in the Main Tailings Area 1 area have an effect on the adjacent wetlands?

Response 2: Impacts to wetlands will be considered during the design phase of the project.

Comment 3: How will the proposed removal action change the Trail Creek aquatic habitat?

Response 3: It is expected stabilization of the mine waste will improve the condition of Trail Creek by reducing metals loading.