FINAL DRAFT

Corkscrew Gulch—Auburn and Iron City Mines

Engineering Evaluation & Cost Analysis (EE/CA)

Grand Mesa, Uncompahgre, and Gunnison National Forests

Prepared For:
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Relevant Acronyms

ABA	Acid Base Accounting
Ag	Silver
AI	Applied Intellect, LLC
Al	Aluminum
AOC	Area of Concern
AOI	Area of Impact
AML	Abandoned Mine Land
ARAR	Appropriate and Relevant Requirement
AR	Administrative Record
ARR	Analytical Results Report
As	Arsenic
BLM	Bureau of Land Management
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
COPEC	Compounds of Potential Ecological Concern
CSM	Conceptual Site Model
Cu	Copper
DRMS	Colorado Department of Reclamation, Mining, and Safety
ECAP	Environmental Compliance and Protection
EE/CA	Engineering Evaluation/Cost Analysis
ESV	Ecological Screening Values
EU	Exposure Unit
ft	Feet
GMUG	Grand Mesa, Uncompahgre, and Gunnison National Forest
HI	Hazard Index
HQ	Hazard Quotient
ICP	Inductively Coupled Plasma
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
IPaC	Information for Planning and Consultation
LCS/LCD	Laboratory Control Sample/Laboratory Control Sample Duplicate
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg/kg	Milligrams per Kilograms
MOC	Media of Concern
MRDS	Mineral Research Data System
MS/MSD	Matrix Spike/Matrix Spike Duplicate
Mt.	Mount
NCP	National Contingency Plan
NF	National Forest
NRWQC	National Recommended Water Quality Criteria
NPS	United States National Parks Service
PA	Participating Agreement

P&I	Plants and Invertebrates
Pb	Lead
QA/QC	Quality Assurance/Quality Control
R2	Rocky Mountain Region (Region 2)
RAO	Removal Action Objective
RDL	Reported Detection Limit
RME	Reasonable Mean Exposure
RPD	Reasonable Percent Difference
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
SDWA	Safe Drinking Water Act
SL	Screening Level
SOW	Scope of Work
SV	Screening Value
T&E	Threatened and Endangered
TBC	To Be Considered
TOS	Tronox “Other” Sites
TU	Trout Unlimited
TVS	Table Value Standards
EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USFS	United States Department of Agriculture, Forest Service
USFWS	United States Fish and Wildlife Service
WMH	Western Mining History
WQCD	Water Quality Control Division

Executive Summary

In 2015, the U.S. Department of Agriculture's Forest Service received $194 million due to the Tronox Environmental Settlement Agreement and the Tronox Fraudulent Transfer Settlement Agreement to resolve claims against Tronox Incorporated, et al. ("Tronox" includes the predecessor company Kerr-McGee and other affiliates). The Tronox Environmental Settlement Agreement provides for the payment of funds, either directly to environmental regulators or through the trusts created pursuant to the settlement agreement, in connection with numerous sites and facilities throughout the country. The payment for these sites will address a wide variety of environmental contamination. Two Areas of Impact (AOI) with impacted mining claims have been identified on Grand Mesa, Uncompahgre, and Gunnison (GMUG) National Forests-managed lands and within Tronox "Other" Sites (TOS) areas. These include the Red Mountain AOI (TOS 1946.4) and the Tomichi Creek AOI (TOS 1909). A total of 38 Tronox "Other" Sites (TOS) within these two AOIs have been identified on the GMUG National Forests. The Red Mountain AOI is located on the Uncompahgre National Forest within Ouray County and contains 37 observed impacts. The Red Mountain AOI is an area of approximately four-square miles and is located within the headwaters of the Uncompahgre River. All TOS are currently inactive.

In 2019, the Forest Service, through an agreement with the EPA, completed a Pre-Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Screening process on nine of the TOS mine sites within the Red Mountain AOI, including XRF and lab sampling of mine wastes and draining adit water. Sites were prioritized, based on potential hazard to humans or resources, the nature of the heavy metals present, the potential of contaminated materials to migrate offsite, whether there is a draining adit at the site, and whether the metal concentrations exceed applicable human health/environmental toxicity benchmarks or water quality standards.

In 2020, the Forest Service completed Preliminary Assessment/ Site Inspection (PA/SIs) reports on five of the sites: Irene (37°56'1.12''N, 107°41'0.45''W), English Maid (37°54'59.24''N, 107°40'13.43''W), Unknown 06 (37°54'56.24''N, 107°40'24.19''W), Auburn (37°54'20.20''N, 107°40'2.42''W), and Unknown 15 (37°55'42.57''N, 107°41'9.06''W). In 2021-22, the GMUG completed a Time Critical Removal Action at the Irene site in partnership with the Colorado Division of Reclamation, Mining, and Safety (DRMS).

In 2021, the USFS, GMUG executed a Participating Agreement (PA) with Trout Unlimited (TU, hereafter) to complete CERCLA, PA/SI, and Engineering Evaluation/Cost Analysis Reports (EE/CAs) at TOS sites located within the Red Mountain AOI. The EE/CA sites covered in this agreement were the Auburn Mine, English Maid Mine, Unknown 06, and Unknown 15 sites. The PA/SI Reports consisted of the Unknown 02 (37°55'21.58"N, 107°39'23.47"W), Unknown 09 (37°54'39.13"N, 107°40'26.53"W), Unknown 11 (37°54'51.26"N, 107°39'15.30"W), and Unknown 14 (37°54'44.24"N, 107°40'30.97"W) sites.

Following the execution of the PA, TU and GMUG staff completed supplementary field studies at all nine sites to further characterize material on-site, human and environmental threats, mobility of materials, and feasibility of removal action steps at each site. With the additional site review, TU and GMUG staff adjusted site nomenclature and sites outlined in the PA. Those changes are important to note and are bulleted below:

- Iron City Mine – added to the PA with Trout Unlimited, this site falls within Kerr McGee claim boundaries, within the Red Mountain AOI outlined in the TOS settlement. The Iron City Mine is in close proximity to the Auburn Mine and Corkscrew Pass Road, which hosts increasing amounts of recreational traffic.

  - Iron City Mine includes the following prominent features: a mine dump upslope of Corkscrew Gulch Road (named Iron City Roadside); the primary mine dump downslope of Corkscrew Gulch Road (named Iron City Waste Dump) that features a partially collapsed adit; and a kill zone below the waste dump (named Iron City Dispersed), resulting from the natural weathering of the waste dump and deposition of mineralized soils.

- Auburn Mine/Unknown 13 – This nomenclature was used for the 2020 PA/SI.
  - The Auburn Mine includes a collapsed adit and a highly mineralized waste rock pile. These features are accessible from Corkscrew Gulch Road by footpath.
  - Downslope of the Auburn waste rock pile a wetland exists, with ponding, saturated soils, and herbaceous vegetation. Water upwells at the toe of slope to create the associated wetland. Investigation of this feature was added to the PA with Trout Unlimited based on visual indication of impact from heavy metals. Shallow groundwater and surface water at the wetland feature comprise the headwaters of Corkscrew Gulch.

Where applicable throughout this document, the Iron City Mine and Auburn Mine will be collectively referred to as the Site. This report presents the results of previous investigations and EE/CA assessments for the Auburn Mine and the Iron City Mine areas of concern (AOC). The multi-site EE/CA was developed using the 2020 Auburn Mine PA/SI report, a 1998 Iron City Preliminary Assessment (PA), and a Site Investigation report complete in 2000. Additionally, Applied Intellect completed the Auburn Mine PA/SI on December 10, 2020, which adheres to contracted commitments and final removal action goals specified by the On-Scene Coordinator (OSC) of the GMUG National Forest. The EE/CA herein was developed in accordance with Environmental Protection Agency (EPA)/540/F-94/009 "Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA" (EPA, 1993).

As is common with all Removal Actions (RAs), it shall be determined if a hazardous substance is present and if a release would present substantial threat to public health or welfare. To properly help determine this need and subsequent actions eight removal factors are considered through the National Contingency Plan (NCP) under 40 CFR Subpart E 300.415 (b)(2). These factors specifically focus on controlling source areas of contamination at hazardous sites by abating, preventing, minimizing, stabilizing, mitigating, or eliminating the potential release of hazardous substances. Per 300.415(b)(2), the eight removal factors are:

(i) Actual/potential exposure to humans or animals or food chain,
(ii) Actual/potential contamination of drinking water or sensitive ecosystems,
(iii) Hazardous substances/pollutants/contaminants in containers which may pose a threat,
(iv) High levels of hazardous substances, pollutants, or contaminants in surface soils that may migrate,
(v) Weather conditions (avalanches and storm events) may cause hazardous substances or pollutants/contaminants to migrate or be released,
(vi) Threat of fire/explosion,
(vii) Availability of other federal/state mechanisms, and
(viii) Other factors that may pose a threat.

The specific primary removal factors that pertain to this project and scope of work are I, IV, and V which are reiterated below along with site-specific justifications:

(i) Actual/potential exposure to humans or animals or food chain. – Given the OHV increased use in the area and public bathroom in proximity to the site, the potential for humans to

interact with contaminated mine waste and water is a concern. There is also an ecological and continual exposure/ingestion risk to animals that are in the area.

(iv) High levels of hazardous substances, pollutants, or contaminants in surface soils that may migrate. Mass wasting and erosion of mine wastes and tailings is visibly evident at all sites.

(v) Weather conditions (avalanches and storm events) may cause hazardous substances or pollutants/contaminants to migrate or be released. Migration of contaminated material from these sites is caused by years of weathering and increased frequency of high flow and precipitation events linked with climate change. Monsoonal events at this elevation are also of concern to continually mobilize fine grained materials downslope.

By completing removal actions focusing on the above factors, partners anticipate the following benefits:

- Stabilization of contaminated material on-site while reducing the ability of that material to migrate or be mobilized off-site;
- Improvement of surrounding environmental conditions and downstream water quality;
- Reduce potential risks to the environment (ecological and aquatic receptors) and humans from exposure to mine wastes at the Site;
- Control runoff from mine waste and minimize erosion; and
- Create a stable, native vegetative cover across the Site that resembles the surrounding area.

Following the findings of exceedance for arsenic, copper, iron, and lead with respect to BLM Recreational, EPA Residential, and/or EPA Industrial screening levels (SLs), the EE/CA identified five potential removal actions for reducing the migration of contaminated material off-site by stormwater, snow melt, or avalanches encountering the waste rock present at the Site. While described in further detail in subsequent sections, arsenic saw an exceedance factor (EFs) above the most conservative SLs of 7176, while copper had an EF of 2, and iron and lead saw EFs of 1.01 and 10, respectively.

The five removal action alternatives for the Auburn and Iron City AOCs are as follows:

- Alternative 1 – On-site repository for Iron City waste material, surface water controls, in-situ soil amendments, site revegetation, rock cap the Auburn
- Alternative 2 – On-site repository constructed, surface water controls, in-situ soil amendments, site revegetation, rock cap the Auburn
- Alternative 3 – On-site repository in-place of all mineralized soils, installation of surface water controls, in-situ soil amendments, site revegetation
- Alternative 4 – Off-site disposal of all mineralized soils, surface water controls
- Alternative 5 – No Action

In accordance with non-time-critical removal action guidance (USEPA, 1993), five 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 ***$818,307.15***. This alternative includes:

- Construct interim surface water controls to convey adit flow around the waste dump at the Auburn Mine portal to allow for removal of associated dump;
- Install surface water controls at the Auburn Mine to convey flow from the adit to the adjacent talus slope;
- Cap the Auburn waste dump with rock sourced from the talus field adjacent to the Site;
- In-situ phytostabilization of the Auburn Wetland and the Iron City Dispersed area to reduce mobilization of existing metals via revegetation and neutralizing soil amendments;

- Consolidate the Iron City Roadside pile into the on-site repository at the Iron City, remediate the cut slope with a mix of angular rock and native soil;
- Run-on/run-off channel construction surrounding the Iron City Waste Dump feature using clay bedding or similar material to minimize surface water infiltration to the site, and angular riprap making up the channel substrate to prevent channel migration;
- Construction of the on-site repository to fully enclose mine waste from the Iron City Roadside, consolidate of all remaining Iron City mine wastes, regrade and cap with native soil generated during repository and surface water channel construction;
- Seed all disturbed areas with native seed mix approved by the USDA FS and amend soil surfaces with material to retain seed and prevent erosion.
- Construct 3 rolling dips along the portion of Corkscrew Gulch Road upgradient of the Iron City Waste Dump. Reconstruct and stabilize eroding road cut slope directly above the Iron City Waste Dump.

A further breakdown of associated actions/tasks and justification for the selected removal action alternative is discussed later in this document. The EE/CA considers the nature and source of contamination, removal factors, and potential risks to ecological and human health and the environment and identifies possible removal actions for Site reclamation. It also presents a recommended alternative based on a comparative analysis of the evaluation factors listed above.

Section 1 – Introduction

1.1 Overview

The United States Department of Agriculture, Forest Service (USFS) Rocky Mountain Region (Region 2 [R2]) has entered into an agreement with Trout Unlimited (TU) to provide an Engineering Evaluation and Cost Analysis Report (EE/CA) for two Tronox "Other" Sites (TOS) legacy mine sites (Site or Sites) located in Corkscrew Gulch, a tributary drainage to Red Mountain Creek, approximately 10.6 miles south of Ouray, Colorado. The Sites described in this report reside on National Forest System (NFS) lands within the GMUG National Forests; a portion of the Auburn site is located on private land (Figures 1 and 2).

The purpose of this document is to: summarize the findings of literary research; summarize the dataset obtained from site sampling events; characterize site conditions and make determinations about waste rock on-site and the threats they pose to human health and the environment. Based on those findings, this EE/CA presents removal action alternatives for the Auburn Mine and Iron City Mine. The EE/CA was developed in accordance with United States Environmental Protection Agency (USEPA) guidance (USEPA, 1993).

1.2 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 migration and mobilization of contaminated material off-site. Threats to human health and the environment associated with exposure to mine waste were analyzed, leading to the following removal action objectives:

- Reduce the potential for migration of hazardous substances, pollutants, or contaminants in Site surface soils (mine waste);
- Reduce potential human and ecological receptor exposure to metal-bearing soils and water in the area of the waste dumps and areas of dispersed mine waste;
- Reduce or eliminate potential physical hazards associated with waste dumps and areas of dispersed mine waste;

- Achieve compliance with Applicable, Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) guidance, to the extent practicable 40 CFR Subpart E 300.415 (j); and
- The removal action selected in this EE/CA evaluation will meet Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements.

1.3 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 – Applicable or Relevant and Appropriate Requirements (ARARs)
Section 5 – Streamlined Risk Evaluation
Section 6 – Identification of Removal Action Scope, Goals and Objectives
Section 7 – Identification and Comparison of Removal Action Alternatives
Section 8 – Recommended Removal Action Alternative
Section 9 – Literature Cited
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Section 2 – Site Description and Summary of Previous Investigations

2.1 Location and Site Description

It should be noted that this EE/CA evaluates two sites within a small geographic area (Figure 1). Each of these sites possess specific attributes associated with Abandoned Mine Land (AML) contamination, as seen in Figure 3, and Tables 5.1 to 5.7. Given the short distance between sites, it was determined that one EE/CA would evaluate all sites included herein to streamline future removal actions. The entire multi-site boundary is located in Ouray County, Colorado in Section 08, Township 42N, Range 7 West of the 6th Prime Meridian. Sites range in elevation from 11,351 feet to 11,618 feet above mean sea level (AMSL), approximately 10.6 miles south of Ouray, Colorado. The Site is accessed via Colorado Highway 550 (Million Dollar Highway) and the Mineral Creek staging area adjacent to HWY 550. Corkscrew Gulch Road, also known as County Road 20A or National Forest System Road (NFSR) 886, leaves the Mineral Creek parking area and heads to the southeast, towards Corkscrew Pass. Corkscrew Gulch Road requires a high clearance, 4WD vehicle for access. The sites within this report are along Corkscrew Gulch Road, with differing levels of accessibility. Based on field visits and data collation, this EE/CA will focus on three sites that have been prioritized by TU and GMUG Staff.

The sites are adjacent to Corkscrew Gulch Road, 0.5 miles downslope of Corkscrew Pass. They are also approximately 3.3 miles from the Mineral Creek staging area, which is a large parking area near Ironton. Corkscrew Gulch Road (NFSR 886), also known as Corkscrew Pass, is seasonally maintained by Ouray County, through an agreement with the USFS. Nearby parking to the Site is marked by an outhouse-style restroom managed by the USFS. The primary feature of the Iron City Mine lies to the south/southeast of the restroom turnout. Prominent features of the Iron City Mine are a roadside waste pile (Iron City Roadside); the primary waste pile (Iron City Waste Dump); host of a partially collapsed and dry adit; and the dispersed sediment caused by weathering of the primary feature (Iron City Dispersed). All features that make up the Iron City Mine lie entirely on NFS lands.

The Site is also comprised of the Auburn Mine, which features a perennially draining adit and a mine dump that originated from the exploration and processing at the portal. The Auburn Mine is a mixed-ownership

feature, where the adit portal and the upper portion of the waste pile lie on private lands. According to Ouray County Assessor accessed at the time of this report (2022-23), this private property is owned by Octagon Minerals, LLC. The MS Number is 17340; the Claim Name is *Auburn Lode*, acreage is 9.508. The tax address for Octagon Minerals, LLC is 7023 Old Relay Road, Ridgway, Colorado, 81432.

2.2 Previous Investigations

Several sources of information were used throughout the investigation to compile as much information as possible for the Site. The primary activity was the review of readily available and reasonably ascertainable regulations, documents, maps, photographs, as well as available information accessed via the internet. This section includes a discussion of sources used in this research, whether or not they provided data specifically related to the Site or were directly referenced in this report.

Inactive and abandoned mine sites in Corkscrew Gulch have been subject to various field investigations to understand the extent of contamination on private, mixed-ownership, and NFS lands, based on the records provided to TU by GMUG staff and the EPA Region 8 staff.

Documents in the Administrative Record (AR) indicate that the Auburn and Iron City Mines were characterized in 2000 by the Colorado Department of Health and the Environment (CDPHE) Hazardous Materials and Waste Management Division and the EPA. The combined assessment examined the sites in Corkscrew and Grey Copper Gulches, the results of which are detailed in an Analytical Results Report (ARR) prepared by CDPHE and the EPA.

The ARR describes a Colorado Geological Survey (CGS) inventory of mines and associated features in 1995 on behalf of the USFS. CGS estimated the volume of mine waste dumps and calculated adit discharge. Samples were collected from a limited number of sites, but GPS coordinates were obtained from all features in the assessment.

In 1998, the Bureau of Reclamation (BOR) was contracted by the USFS to prepare Preliminary Assessments on mine sites on or adjacent to NFS Lands in Corkscrew and Grey Copper Gulches. In 2000, an SI report was completed, and with Site characterizations of soil and surface water at the Iron City Mine. These reports were used as the PA/SI for Iron City in addition to soil sampling and characterization of the extent of contamination completed by TU during the 2021-22 field seasons.

In 2019, EPA completed a Pre-CERCLA Screening (PCS) Checklist and NPL Decision at nine Red Mountain TOS Sites, with support from TechLaw Environmental Services Assistance Team (ESAT). EPA and ESAT support Federal and State partners across USFS Region 2 and EPA Region 8 to complete site characterizations at historic mining sites via an interagency agreement. The results of the EPAs field study for Corkscrew and Grey Copper Gulch were referenced for completing this multisite EE/CA.

In 2020, Applied Intellect (AI) completed PA/SIs for Auburn Mine, Irene, English Maid, Silver Bell Dispersed Tailings (Unknown 15), and Unknown 06. Site descriptions, soil and surface water sampling results. Relevant information from the Auburn PA/SI were used to generate this multisite EE/CA.

2.3 Geology

The Ironton Quadrangle resides in the Quaternary aged glacial drift, the youngest unit in the vicinity of the Auburn Mine (Figure 5). These deposits are underlain by Tertiary rocks of the Henson Formation (Tsh), comprised of dark volcanic flows, breccias and tuffs of mainly rhyodacitic composition. The discussion of the regional geology below addresses hydrothermal alteration of these Tertiary-aged volcanic rocks as study areas for economic reserves in the late 1800's.

On a regional scale, the Auburn Mine is situated on the northwest side of the San Juan caldera, where Miocene-aged volcanic flows were deposited unconformably against the steep slopes of the caldera wall (USGS, 1973). The caldera subsidence preceded the volcanic flows. The San Juan caldera spans approximately 20 kilometers, and is amongst the major calderas (Uncompahgre, Silverton, and Lake City) in the western San Juan Mountains. The sequence of mid-Cenozoic volcanic events in the western San Juan Mountains is closely analogous to that elsewhere in the San Juan volcanic field. The Lake Fork, Picayune, and San Juan Formations were erupted from a cluster of central volcanoes from 35 to 30 million years ago, when dominant activity shifted to more silicic ash-flow eruptions with accompanying caldera collapses. The Uncompahgre and San Juan calderas, each about 20 km across, formed mainly from eruption of the 28 million years old Sapinero Mesa Tuff. Collapse occurred concurrently with eruption, and intra-caldera tuffs accumulated to a thickness of more than 700 m. Both calderas were resurgently domed together; the northeast-trending Eureka graben formed along the distended crest of that dome. The Uncompahgre caldera was then flooded by several 27 to 28 million years old ash-flow sheets from easterly sources, and by one that apparently erupted from the Silverton caldera nested within the older San Juan caldera (USGS, 1973).

Mineralization related to the different ash-flow calderas in the San Juan field occurred mostly late in the local cycle, during and spatially associated with post-subsidence magmatic activity. The activity typically emplaced lavas and intrusives along ring fractures and outward-extending radial fractures of the calderas and was related in time and space to the mineralization. These generalizations seem valid for the individual calderas in the western San Juan Mountains, but the multiple caldera cycles resulted in several periods of mineralization (USGS, 1973).

The western San Juan Mountains are one of the major mineralized areas in the Rocky Mountain region, with about one-half billion dollars total metal production in the last 100 years (USGS, 1973). The geology of this region has been studied intensively for many years. Geologic folios date back to 1899 and were among the first studies anywhere to determine detailed stratigraphic relations in propylitically and hydrothermally altered Tertiary volcanic rocks (USGS, 1973).

2.4 Hydrology

The Auburn Mine is situated at approximately 11,500 feet AMSL and makes up the headwaters of Corkscrew Gulch. Steep mountainous terrain is located both to the south and east of the Site, with nearby peaks up to 12,600 feet AMSL. The USGS Ironton, Colorado Quadrangle (Figure 5) indicates that the Corkscrew Gulch flows northwest to Red Mountain Creek, located approximately 2.3 miles from the Site along US Highway 550.

The Auburn and Iron City Mines are situated at the origin of Corkscrew Gulch. This surface water segment (Figure 6) is defined as COGUUN06b_A according to Colorado’s Water Quality Control Division (WQCD). This surface water segment includes the mainstem of Red Mountain Creek from immediately above the confluence with the East Fork of Red Mountain Creek to the confluence with the Uncompahgre River and all tributaries to Red Mountain Creek within Corkscrew and Champion basins.

As part of the PA/SI, Applied Intellect quantified adit flow from the Auburn Mine portal at 0.05 CFS or 22.44 GPM. Adit discharge may fluctuate with seasonal snowmelt, but annual flows have not been evaluated due to winter access constraints. TU assumes adit discharge ranges between 3.23 and 22.44 GPM with 3.23 GPM being the more likely flow rate given the measurement technique. While this adit could see increases in flow seasonally, the workings and catchment basin above the adit opening would limit those flow rates. Point source discharge flows from the portal over the top and face of the mine waste pile. Surface flow is

lost at the toe of the mine dump, where the surface material transitions to native talus. Surface flows reemerge at the toe of the slope in wetland, an area that seasonally saturates with snowmelt and adit discharge, and an area that displays little to no vegetative recruitment.

Section 3 – Source, Nature, and Extent of Contamination

Initially, TU investigated eight Red Mountain TOS Sites as Areas of Concern (AOCs). This work builds upon the EPA PCS report completed in 2019, and the PA/SIs for the English Maid, Unknown 06, Silver Bell Dispersed Tailings, and the Auburn Mine, all of which were completed in 2020. Upon initial investigations by TU and USFS staff, two additional AOCs were identified; the Iron City Mine and a wetland feature impacted by the Auburn Mine based on its orientation downslope of the Auburn. TU and USFS staff investigated this wetland feature by collecting a 30-point composite sample that was compared to the 2019 EPA PCS report and the Auburn PA/SI. The wetland below the Auburn Mine has a kill-zone, which is likely attributed to two primary factors: shallow upwelling of metal-laden adit water and non-point source metals loading stemming from the Auburn Mine waste dump. The Iron City Mine is situated 0.18 miles (960 linear feet) north and west of the Auburn Mine. The Iron City Mine features a partially collapsed dry adit portal with a rod-iron closure (Iron City Adit) and a small waste dump situated upslope immediately adjacent and upslope of Corkscrew Gulch Road (Iron City Roadside), a large waste dump with a collapsed portal (Iron City Waste Dump) below Corkscrew Gulch Road, and a kill-zone of dispersed material (Iron City Dispersed) associated with the mobilization of metal-laden sediment from the Iron City Waste Dump.

Following that visit, the USFS GMUG conducted a cadastral survey to confirm that all Site features reside on NFS lands. Based on available parcel layers and survey data, the Auburn Mine wetland, a portion of the Auburn Mine waste dump, and the Iron City Mine sites are situated on NFS lands within the Uncompahgre National Forest. The Auburn adit portal and the upper portion of the Auburn Mine waste dump is located on private land (see Section 2.1).

3.1 Areas of Concern

Based on data collected by Applied Intellect, the EPA, CDPHE, and the CGS, there are two main areas of concern, comprising several mine features, presented in this EE/CA:

- The **Auburn Mine**, comprised of a waste rock pile and the associated adit effluent, including a seasonally saturated wetland with a visible kill-zone below the mine; and
- The **Iron City Mine**, comprised of a roadside waste rock pile, a primary waste dump, a partially collapsed, dry adit, and dispersed material and kill-zone below the mine features.

3.1.1 Auburn Mine Waste Dump

According to the Auburn Mine 2020 PA/SI, waste rock and the surface water from the adit portal present Contaminants of Potential Concern (COPC) and Contaminants of Potential Environmental Concern (COPEC) that warranted ongoing CERCLA investigations. The EPA Pre-CERCLA Screening (PCS) was completed in 2019, which identified soils and surface water concerns at the Auburn Mine. In both the EPA PCS and the PA/SI, a 30-point composite soil samples of the waste rock pile and a composite background soil sample were collected for laboratory analysis.

2019 EPA PCS Sample Summary:

ABR-SW-A01-01 represents total recoverable and dissolved metals concentrations in adit drainage from the top of the waste rock pile and adjacent to the adit.

ABR-SW-A02-02 represents total recoverable and dissolved metals concentrations in adit drainage from the bottom of the waste rock pile before water flows subterranean.

Soil Samples (30-point composite):
ABR-SO-MP01-01
ABR-SO-MP01-02 (grab)
ABR-SO-MP01-03 (grab)
ABR-SO-MP01-04 (grab)
ABR-SO-MP01-05 (grab)
ABR-SO-BKG-01

From the EPA PCS (sample date 9/18/2019), the soil sample results were reported in the form of total metals as:

- Arsenic (As) in soil is moderately elevated with a maximum value detected of 558 ppm, exceeding BLM Recreational Screening Levels (SLs) by 18 times;
- Lead (Pb) in soil is elevated with a maximum value detected of 1,010 ppm, exceeding the BLM Recreational SL by 1.25 times;

From the EPA PCS (sample date 9/18/2019), the surface water sample results were reported as:

- **Adit Portal Water Sample (ABR-SW-A01-01):** Total Recoverable—Aluminum, arsenic, cadmium, copper, lead, manganese, and zinc, all exceeded the Chronic Water Quality Standards.
- pH: 2.06
- Flow (CFS): 0.0072

Table 3.1: EPA PCS Auburn adit water sample results (09/18/19) summary table for sample ABR-SW-AO1-01

Analyte	Total Recoverable Concentration (µg/L)
Aluminum	1,050,000
Arsenic	1440
Cadmium	47
Copper	70,400
Lead	112
Manganese	3,180
Zinc	10,200

- **Bottom of Waste Rock Water Sample (ABR-SW-A01-02):** Total Recoverable—Aluminum, arsenic, cadmium, copper, lead, manganese, and zinc, all exceeded the Chronic Water Quality Standards.
- pH: 2.16
- Flow (CFS): N/A

Table 3.2: EPA PCS Auburn adit water sample results (09/18/19) summary table for sample ABR-SW-AO1-02

Analyte	Total Recoverable Concentration (µg/L)
Aluminum	1,050,000
Arsenic	1440
Cadmium	42.5
Copper	69,700
Lead	85
Manganese	3,180
Zinc	9,700

2020 PA/SI Sample Summary:

Auburn Adit Water

- AU-SWT-AD-1 and duplicate AU-SWT-AD-2 (total metals), and
- AU-SWD-AD-1 and duplicate AU-SWD-AD-2 (dissolved metals)
  - A second water sample flowing from the adit was collected downstream on the waste pile before the flow infiltrated underground. The sample was identified as AU-SWT-WP1-1 (total) and AU- SWD-WP1-1 (dissolved).
  - The surface water samples were collected using a peristaltic pump and disposable tubing. The water samples for total metals were collected directly into 250-milliliter (ml) containers from the laboratory that were pre-preserved with nitric acid. Surface water samples for dissolved metals were collected separately and field-filtered using disposable 0.45-micron filters. The filtered dissolved metal samples were also preserved with nitric acid.

Auburn Adit Sediment

- AU-SED-AD-1 and duplicate sample AU-SED-AD-2.

Auburn Soil sample results for AU-SS-WP-1-1 and AU-SS-WP-1-2 were concluded as:

- Arsenic is a COPC in the waste pile soil, and the pathway is potentially complete for workers and recreational visitors; and
- Antimony, arsenic, cadmium, copper, lead, selenium, silver, and zinc are COPECs in waste pile soils, and the pathway is potentially complete for ecological receptors.

Analytical results for mine-impacted adit sediment at the Auburn Site indicate:

- The sediment pathway is potentially complete but insignificant for work recreational visitors; and
- Arsenic, copper, iron, lead, and selenium are COPECs in adit drainage sediment.

Among analytes that exceeded ecological SLs, Table 3-3 includes the arsenic SL exceedance and the 3x maximum background soil concentration exceedances identified in duplicate waste pile samples AU-SS-WP1-1/AU-SS-WP1-2. These results are also presented in Table 5-1 and Table 5-4 from the Auburn PA/SI.

Table 3.3: Summary of soil sample results presented in the Auburn PA/SI comparing regulatory screening levels (SLs) and a composite background sample

PA/SI Soil Sample Results Compared to Screening Levels (SLs)								
Analyte	**AU-SS-WP-1-1 Max Concentration (mg/kg)**	**AU-SS-WP-1-2 Max Concentration (mg/kg)**	**BLM Recreational SL (mg/kg)**	**EPA Industrial SL (mg/kg)**	**BLM Recreational SL Exceedance Factor**	**EPA Industrial SL Exceedance Factor**	**Background Result (mg/kg)**	**Background Max Exceedance Factor**
Antimony	1100	893	782	470	<.01	<.01	6.8	162
Arsenic	438	392	30.6	3	14	150	63.3	6.9
Cadmium	3.30	2.17	1780	980	<.01	<.01	0.137	24
Copper	557	485	78200	47000	<.01	<.01	19.5	29
Lead	837	660	800	800	1	1	253	3.3
Selenium	12.9	3.08	9780	5800	<.01	<.01	2.85	4.5
Silver	15.6	10.7	9780	5800	<.01	<.01	1.13	14
Zinc	509	460	587000	350000	<.01	<.01	32.5	16

Table 3.4: Summary of soil sample results presented in the Auburn PA/SI comparing NPS Streamlined Ecological Risk Assessment (SLERA) metals concentrations to Ecological Screening Values (ESVs). Results only show analytes that exceed ESVs

PA/SI Sediment Results Compared to Ecological Screening Values (ESVs)					
Analyte	**NPS SLERA ESV Sediments (mg/kg)**	**AU-SS-WP-1-1 Max Concentration (mg/kg)**	**ESV EF**	**AU-SS-WP-1-2 Max Concentration (mg/kg)**	**ESV EF**
Arsenic	9.7	494	51	482	50
Copper	28	125	4.5	161	5.8
Iron	2e+04	188000	9.4	234000	12
Lead	35	580	17	743	21
Selenium	0.5	33.0	46	34.4	48

Surface water sample results were concluded as:

- Arsenic, cadmium, chromium, copper, lead, selenium, and thallium are COPCs in adit drainage water under the drinking water standard; while this scenario is considered unlikely, the pathway is considered partially complete for human receptors; and
- Aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, and zinc are COPECs in adit drainage water, but the pathway is not complete.

Table 3.5: Adit Water Sample Results presented in the Auburn PA/SI Compared to EPA drinking water standards (Dissolved Metals)

Analyte	EPA Tapwater ESL (µg/L)	AU-SWD-AD-1 Result (µg/L)	EF	AU-SWD-AD-2 Result (µg/L)	EF	AU-SWD-WP1-1 Result (µg/L)	EF
Aluminum	20000	561000	28	564000	28	529000	26
Antimony	7.8	114	15	103	13	111	14
Arsenic	0.052	967	19000	966	19000	919	18000
Cadmium	9.2	25.1	2.7	25.6	2.8	23.2	2.5
Cobalt	6	1400	230	1410	240	1330	220
Copper	800	3660	46	36600	46	34700	43
Iron	14000	1860000	130	1870000	130	1760000	130
Lead	15	86.4	5.8	89.3	6	66.3	4.4
Manganese	430	1460	3.4	1470	3.4	1390	3.2
Nickel	390	1090	2.8	1120	2.9	1040	2.7
Thallium	0.2	<21.6	110*	<21.6	110*	<21.6	110*
Vanadium	86	813	9.5	815	9.5	771	9

Table 3.6: Adit Water Sample Results presented in the Auburn PA/SI Compared to maximum contaminant levels for Total Metals. *Only Presents SL Exceedances

Analyte	EPA MCL (µg/L)	AU-SWT-AD-1 Result (µg/L)	EPA MCL EF	AU-SWT-AD-2 Result (µg/L)	EPA MCL EF	AU-SWT-WP1-1 Result (µg/L)	EPA MCL EF
Arsenic	10	914	91	954	95	852	85
Cadmium	5	45.3	9.1	49.2	9.8	42.2	8.4
Copper	1300	39100	30	40700	31	36200	28
Lead	15	93.9	6.3	84.9	5.7	58.9	3.9

The analytical data in **Section 3.1.1** summarizes soil and water quality SL and ESV exceedances from the 2019 EPA PCS and the 2020 PA/SI. Water quality exceedances presented in Table 3.1 and Table 3.2 of this section compare surface water results to table value standards (TVS) according to the Colorado WQCD segment standards. The results presented in the PA/SI are also relevant, and reference EPA tapwater with respect to maximum contaminant level (MCL). These levels correlate to direct ingestion and the relation of this Site to drinking water supplies or wells. Section 2.6.4 of the Auburn PA/SI investigated distance to drinking water wells located 3 kilometers from the site (USEPA 1992a). According to the Colorado Division of Water Resources (CDWR) database, there is one household well approximately 1.86 miles from the Auburn and in a separate drainage. There are additional other wells within 2.5 to 3.7 miles from the site that are geographically isolated from any water quality impacts associated with the AOCs.

The MCL exceedance factors (EF) referenced in Table 3-6 support the findings of the EPA PCS analytical results. These data show that Auburn adit water and downslope sites are greatly elevated over EPA MCLs for arsenic, cadmium, copper, and lead with exceedance factors ranging from 85 to 91, 8.4 to 9.8, 28 to 31, and 3.9 to 6.3, respectively. While drinking water and associated standards might not be a driving factor due to proximity of that infrastructure, these data help visualize the problem regarding the respective standards.

Of note, total metals in the adit effluent measured in the EPA PCS identify copper concentrations at 70,400 (µg/L) and zinc at 10,200 (µg/L). The sampling carried out for the PA/SI revealed maximum copper concentrations at 40,700 (µg/L) and maximum Zinc at 5,500 (µg/L). The 1999 Site Investigation of Corkscrew Gulch states, “the adit flow (Auburn) is estimated to flow at 25 gpm and has a pH of 2.2 and a

conductivity of 6,760 µS/cm. According to the USFS Abandoned Mine Land Inventory (AMLI), pH values are the lowest found anywhere in the Red Mountain Mining District area, and the conductivity levels are among the highest ever encountered."

3.1.2 Auburn Wetland

During 2021 field season site visits, TU and USFS staff identified an additional AOC below the Auburn Mine in what was identified as a seasonal wetland based on soil saturation, percent organics, and present vegetation. Based on these findings, TU and USFS staff named this AOC the Auburn Wetland.

With a further review of previous studies summarized in Section 2.3 of this report, TU determined that the sediments and surface water at this wetland feature had not been characterized. Initially, a 30-point composite sample of surface soils was collected on October 5, 2021, and submitted to ACZ Laboratories. TU made an additional attempt to capture surface water at this site on October 27, 2021, but could not access the upper Corkscrew Gulch due to weather conditions.

It was not until the spring of 2022 that TU visited the Site with surface water on-site. However, samples could not be taken due to a lack of surface water two days later. The lack of flow at this site makes it difficult to assess the total impact this site may have on Corkscrew Gulch, which has been documented in the 1998 & 2000 PA/SIs to have a pH range of 2.9 to 4.02 (CDPHE, 2000). What the field visits did determine, however, is that surface water at the Auburn Wetland is highly intermittent and mainly driven by snowmelt. However, this limited duration of fresh dilution flows might not be enough to offset the contamination of intermittent surface flow into the wetland from the Auburn Mine adit discharge upslope.

This section summarizes the 2021 composite soil sample data (ACZ Lab Report L784879) used to determine Site AOCs.

Table 3.7: Auburn Wetland Soil Sample Results Compared to Regulatory Screening Levels (SLs). *Only Presents SL Exceedances

Exceedance Summary Table							
Analyte	Auburn Wetland Result (mg/kg)	BLM Recreational SL	Recreational EF	EPA Residential SL	Residential EF	EPA Industrial SL	Industrial EF
Arsenic	90.60	30.6	3	0.68	133	3	30
Iron	147,000	1,000,000	0	55,000	3	820,000	0

It is important to note that the SL exceedances presented in Table 3.7 are focused on BLM recreational (14 days/year), EPA residential (350 days/year), and EPA industrial (225 days/year). While some of the residential and industrial levels might not apply at this Site, recreational levels should be considered given the usage and potential camping that takes place in the area.

Table 3.8: Auburn Wetland Soil Sample Results Compared to Regulatory ESVs for Plants, Invertebrates, Birds, and Mammals. *Only Presents ESV Exceedances

Soil Ecological Screening Values (mg/kg)								
Analyte	**Plants SL**	**Plants EF**	**Invertebrates SL**	**Invertebrates EF**	**Birds SL**	**Birds EF**	**Mammals SL**	**Mammals EF**
Arsenic	18	5	6.8	13	43	2	46	2
Chromium	--	-	0.4	39	26	1	34	-
Copper	70	3	80	2	28	6	49	4
Lead	120	2	1700	-	11	20	56	4
Selenium	0.52	12	4.1	1	1.2	5	0.63	10
Silver	560	-	--	-	4.2	2	14	1

Based on the data presented in Tables 3.7 and 3.8, TU recommends that this AOC be included in a Non-Time Critical Removal Action (NTCRA), in conjunction with any reclamation activities taking place at the Auburn and Iron City Sites. Soil SL exceedances of all BLM and EPA regulatory standards for arsenic are the main driver for recommended reclamation. One thing to consider is the maximum background concentration of arsenic measured in the PA/SI was 63.3 mg/kg (Table 3.3), which also exceeds all regulatory SLs. To further validate the need to include the wetland in removal actions are the data presented in Table 3.8. All metals listed in the table exceed at least one ecological screening value. For example, the chromium concentrations present in the wetland soils exceed the screening levels for invertebrates by 39X. Data indicates lead as a primary risk for birds with a 20X increase over ESVs for that receptor group. As mentioned prior regarding arsenic, all receptor group ESVs are exceeded with the invertebrate ESV being exceeded by 13X. While arsenic might have a high background concentration, other metals exhibit potential harm to ecological receptors.

Acid-base accounting does indicate that the Auburn Wetland has a relatively high acid-generating potential (AGP) of 38.4, with a saturated pH of 3.3. Section 5 details the methods and procedures used to calculate and assess acid-generating potential in accordance with the Pennsylvania Department of Environmental Protection (PDEP) Coal Mine Drainage Prediction and Pollution Prevention Report (1988). To combat acid-generating potential, TU recommends soil neutralizing amendments and in-situ phytostabilization as a removal action strategy for this AOC—Sections 7 and 8 of this report detail Removal Action strategy and alternatives.

3.1.3 Iron City

Like the Auburn Wetland, the Iron City site was added to the Red Mountain TOS agreement based on 2021 Site visits by TU and USFS staff. Additionally, the USFS Region 2 Environmental Engineer recommended the addition of the Iron City to the TOS agreement based on the scale of the site and the proximity to Corkscrew Gulch Road, which has seen a steady increase in seasonal recreational use. For example, the average daily traffic on Corkscrew Gulch Road was 262 vehicles. These recreational users could have multiple persons in each vehicle that access some of these sites when in the area.

Additionally, CDPHEs Combined Assessment (CA) completed in 2000 details an assessment of the Iron City Mine (Appended Table 5, Site SO-02; CDPHE, 2000). Information and data presented in the CDPHE CA to inform CERCLA steps as part of this multi-site EE/CA. Table 3.9 details the results of the former site inspection. SL Exceedances identified in the 2000 CA coincide with SL exceedances identified in TU's 2021 site assessment; arsenic and lead exceeded BLM Recreational SLs.

Table 3.9: Iron City Waste Dump Exceedance Summary Table

Analyte	BLM Recreational SL (mg/kg)	EPA Residential SL (mg/kg)	EPA Industrial SL (mg/kg)	Waste Dump (mg/kg)	Roadside (mg/kg)	Dispersed (mg/kg)	SL Exceeded
Arsenic	30.6	0.68	3	1,480	4,880.00	320.00	All SLs
Copper	78,200	3,100	47,000	3,280	6,060	113	EPA Residential
Iron	>1,000,000	55,000	820,000	19,300	55,300	44,900	EPA Residential
Lead	800[a]	400	800	1,360	4,120	234	All SLs

3.2 Lab Analysis

ACZ Laboratories analyzed the four composite soil/sediment samples for total metals, Toxicity Characteristic Leaching Procedure (TCLP), and Synthetic Precipitation Leaching Procedure (SPLP). ACZ Las analyzed soils from the following features: Auburn Wetland, the Iron City Roadside, Iron City Waste Dump, Iron City Dispersed. The analytical lab methods of detection were as follows:

- ICP USEPA Method 6010B for barium, beryllium, chromium, copper, iron, manganese, nickel, vanadium, and zinc;
- ICP-MS Method 6020 for antimony, arsenic, cadmium, and lead; and
- EPA method M1312 for SPLP; and
- EPA method M1311 for TCLP Metal Extraction.

ACZ also analyzed the four composite soil/sediment samples for acid generation, base neutralization, and acid-base potential by ABA Method 600/2-78-054. *Acid-base accounting was not completed for soils analyzed in the PA/SI (Auburn Waste Dump).

- Saturated Paste Extraction USDA No. 60(2)

Pages 21 through 26 of ACZ lab report, Appendix C, L39437 Analytical Report is the Inorganic Extended Qualifier Report, which identifies specific laboratory QA issues and describes the corrective actions.

3.3 Limitations

The findings presented herein are based upon observations of the Site conditions as of the date the assessment was performed, and the results and conclusions presented herein should not be assumed to apply to changes in conditions on this property since the on-site investigation. During this assessment, TU relied on information provided by outside sources, including but not limited to local government officials, regulatory agencies, and reasonably ascertainable records sources. For this assessment, the third-party information is assumed to be accurate unless otherwise noted, and TU cannot guarantee the information obtained in literature reviews from third-party sources is void of any error. Additionally, it should be noted that the accessibility of data may be limited, particularly regarding historical Site uses. Any such limitations that are essential to the conclusions made about the Site will be identified in the report.

Section 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 Site are identified and summarized in Appendix B. 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, Removal Action, location, or other circumstance found at a CERCLA site. “Relevant and appropriate” requirements refer to cleanup standards, standards of control, and other 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, Removal 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.

Location-Specific ARARs are restrictions on concentrations of hazardous substances or the conduct of removal 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.

“To Be Considered” (TBC) Criteria are addressed when occasionally, 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 TBD requirements and are not legally binding, and do not have the status of potential ARARs.

Section 5 – Streamlined Risk Evaluation

5.1 Methods

This streamlined risk evaluation was completed in accordance with USEPA guidance for human health (USEPA, 1989) and ecological (USEPA, 1998) risk assessments. This screening-level approach was designed for sites with limited data sets to evaluate relative risk associated with COPCs or COPECs to determine if risks are acceptable or if CERCLA Removal Actions are necessary to lower the risks to acceptable levels.

5.2 Sampling and Analysis

Soil assessments were performed in the 2019 PCS and in the 2020 PA/SI. The results of those sampling efforts and subsequent reports are presented in Section 5.2 subsections. PA/SI data tables presented are replicated for this EE/CA and manipulated to fit the formatting of this document, but the data present therein have not been altered or adjusted. The EPA did include XRF measurements of the Auburn Waste Pile and the Background Sample (See PCS Report).

PA/SI Sample Sites/Names:

- Soil:
  - Background – AU-SS-BKG-1
  - Waste Pile – AU-SS-WP1-1; AU-SS-WP1-2 (Duplicates)
  - Adit Sediment – AU-SED-AD-1/AU-SED-AD-2 (Duplicates)

EPA PCS Sample Sites/Names:

- Soil:
  - Background – ABR-SO-BKG-01
  - Waste Pile – ABR-SO-MP1-01; ABR-SO-MP1-02; ABR-SO-MP1-03; ABR-SO-MP1-04; ABR-SO-MP1-05

TU Post-PA/SI Samples:

- Soil:
  - Tronox Auburn Wetland – 30 PT Composite
  - Tronox Iron City Waste Rock – 30 PT Composite
  - Tronox Iron City Dispersed – 30 PT Composite
  - Tronox Iron City Small Dump (Roadside) – 15 PT Composite

As mentioned in Section 3, TU reviewed the EPA PCS report and PA/SI to determine the scope of previous investigations. Following that review, TU and USFS staff completed several additional site visits in 2020 and 2021 to understand site characteristics and whether there were any additional AOCs in Corkscrew Gulch that needed to be included this EE/CA. These visits resulted in the collection of aforementioned soil samples and are presented below in section 5.2.2.

5.2.1 Auburn Mine Soil Data

The Auburn Mine site and associated features of waste rock soil and background soil area had a composite analyte test completed for human health and ecological screening levels. These results that are described below originate from the 2020 PA/SI and are therefore a summary of that data. Locations of each type of sample (Figure 7) and results are listed in Table 5.1 through Table 5.7. Tables were included in the text in prior revisions of the EE/CA and have been removed at the request of partners.

Waste Rock Soil Composite Analyte Sample Results for ABR-MP01-01, ABR-MP02-01, and ABR-SO-MP01-01, respectively.

- Arsenic had 3x exceedance factors (EF) for the following Human health screening levels.
  - Recreational and Industrial Level EFs of 9.8x and 100x at 300 mg/kg concentration of Arsenic. (Table 5.1)
- Ecological screening levels based on assessments presented in Table 5.2. Note that for the purposes of the following sections, BKG=Soil background, P=plants, I=insects, B=birds, and M=mammals with regards to ecological receptor groups.
  - An Antimony concentration of 60.8 mg/kg exceeded BKG and B&M at 20x and 230x.
  - An Arsenic concentration of 300 mg/kg exceeded BKG, P&I, and B&M at 5.2x, 17x, and 7x.

- A Cadmium concentration of 2.22 mg/kg exceeded BKG and B&M at 32x and 6.2x.
- A Copper concentration of 393 mg/kg exceeded BKG, P&I, and B&M at 17x, 5.6x, and 14x.
- A Lead concentration of 520 mg/kg exceeded BKG, P&I, and B&M at 6.4x, 4.3x, and 47x.
- A Mercury concentration of 1.35 mg/kg exceeded BKG at 27x.
- A Potassium concentration of 11,800 mg/kg exceeded BKG at 9.4x.
- A Selenium concentration of 12.6 mg/kg exceeded BKG, P&I, and B&M at 5.4x, 24x, and 20x.
- A Silver concentration of 39.9 mg/kg exceeded BKG and B&M at 93x and 2.8x.
- A Thallium concentration of 2.56 mg/kg exceeded BKG at 5.3x.
- A Zinc concentration of 551 mg/kg exceeded BKG, P&I, and B&M at 24x, 4.6x, and 12x.

During 2021 site visits, TU collected several opportunistic composite soil samples from the Auburn Wetland (Figure 8) and Iron City Mine Sites (Figure 9), because it was apparent at that time that the Iron City was a large, abandoned mine site residing on USFS lands that had not been included in either the EPAs PCS or the PA/SI. As described in Section 3, this wetland was devoid of vegetation along the valley bottom, yet the soils at the margins of this feature appeared to be comprised on native organics.

The data is presented in Table 5.8 through Table 5.11 by ACZ Labs (Report L784879, Appendix C). Values presented by ACZ labs were used to determine regulatory exceedances of established screening levels and to establish COPCs and COPECs for each respective site. This data for the Auburn Wetland is summarized below to ensure all site features for the Auburn are discussed in one section.

The total metal concentrations in the Auburn Wetland composite soil samples compared to Human Health regulatory SLs were used to identify site-specific COPCs (Table 5.8, Table 5.9). Two metals, Arsenic and Iron exceeded human health SLs. Arsenic, 90.6 mg/kg, exceeded Recreational SLs with an exceedance factor of 3X, Residential SLs were exceeded by a factor of 133X, and Industrial screening levels were exceeded by a factor of 30x. Iron, 147,000 mg/kg, also exceeded Residential SLs with an EF of 3x.

Auburn Wetland Soil Sample Results (from the 2021 sampling event) compared to Regulatory Ecological Screening Values (ESVs) for Plants, Invertebrates, Birds, and Mammals can be seen in Table 5.10**,** results are listed in Table 5.11**,** which compare Max concentrations to ESVs and show a relation to exceedance factors, hazard quotients and percent of total risk present at the site. A further description of hazard quotients and % of risk will be discussed in the next section. It should be noted that total percent risk takes into account all of the metals listed in Table 5.11 and what their relation is to total risk on all receptor groups. This technique offers a succinct snapshot of which metals pose the greatest risk when considering all receptor groups.

- Arsenic levels of 90.6 mg/kg with EFs of 5x, 13x, 2x and 2x with respect to plant, invertebrate, bird and mammal receptor group ESVs. Of the COPECs, Arsenic represents 20.7% of the total risk to ecological receptor groups.
- Chromium levels of 15.5 mg/kg with EFs for Invertebrates of 39x. Of the COPECs, Chromium represents 36.8% of the total risk.
- Copper levels of 177 mg/kg with EFs of 3x, 2x, 6x, and 4x with respect to plant, invertebrate, bird and mammal receptor group ESVs. Of the COPECs, Copper represents 13.6% of the total risk.
- Lead levels of 120 mg/kg with EFs for Plants (2x), Birds (20x), and Mammals (4x). Of the COPECs, lead represents 23.8% of the total risk.
- Selenium levels of 0.52 mg/kg with EFs for Plants (12x), Birds (5x), and Mammals (10x).

- Silver levels of 560 mg/kg with EFs for Birds (2x) correlating to a total risk of 2.7% with respect to ecological receptor groups.

5.2.2 Iron City Soil Sample Results

All of the data summarized below was collected by USFS and TU during the 2021 field season in an effort to characterize all site features of the Iron City that were not evaluated in past PCS or PA/SI work. Below includes a conversation about human health exceedances with respect to BLM and EPA screening levels, as well as an associated Streamlined Ecological Risk Assessment (SLERA). TU decided to include a SLERA for Iron City as part of this EE/CA to build on the ecological evaluation already completed in the 2020 PA/SI for the Auburn site. An explanation of parameters and approach for that SLERA is included in subsequent sections.

Human Health Screening Level Evaluation:

This section summarizes the appended ACZ Lab report (ACZ Lab Report L67564-R11211109) composite soil sample results presented in Table 5.12 through Table 5.15. Four sample data results are presented, respectively, in the aforementioned Tables and summary, the 2021 Iron City Waste Dump results, 1999 SI Iron City Waste Dump results, 2021 Iron City Roadside Dump results, and the 2021 Iron City Dispersed area results (Figure 3). Total metal concentrations are compared to SLs to identify Contaminants of Potential Concern (COPC). Screening Levels are for Recreational, Residential, and Industrial.

- Arsenic levels exceed all SLs at all sample locations.
- Copper levels exceed Residential SLs at the Waste Dump & Roadside locations.
- Iron exceed Residential SL at the Roadside location.
- Lead levels exceed all SLs at the Waste Dump & Roadside locations.

The 2021 Iron City Waste Dump samples (Table 5.13), and 1999 SI Waste Dump samples (Table 5.14) assess EFs for Recreation, Residential, and Industrial SLs . Arsenic and Lead exceeded Recreation, Residential, and Industrial SLs. Arsenic levels for the 2021 Waste Dump sampling and 1999 SI sampling event were 1,480 mg/kg and 489 mg/kg, respectively. These data suggest a concentration of the analyte with EFs at 48x, 2176x, and 493x for the 2021 Waste Dump sampling event and 16x, 719x, 163x at the 1999 SI event for Recreation, Residential and Industrial screening levels, respectively. Lead levels for the 2021 Waste Dump sampling and 1999 SI sampling event were 1,360 mg/kg and 729 mg/kg, respectively. Exceedance Factors for the three SLs are 2x, 3x, and 2x (respectively), for the Waste Dump sampling event, but only exceed the Residential SL, 2x, for the 1999 SI event.

The Iron City Roadside Soil Sample and Iron City Dispersed sample results can be seen in Table 5.15 and Table 5.16, respectively. These Tables present SL exceedances for Arsenic, Copper, and Lead. The concentrations of these parameters were evaluated against SLs for Recreation, Residential, and Industrial to come up with corresponding exceedance factors. Arsenic levels of 4,880 mg/kg for the Roadside site correlated with EFs of 159x, 7176x, and 1627x for Recreational, Residential, and Industrial screening levels. Copper levels at the Roadside site were 6,060 mg/kg with an EFs of 2x with respect to Residential SLs. Roadside Lead levels of 4,120 mg/kg with EFs corresponded to 5x, 10x, and 5x with respect to Recreational, Residential, and Industrial SLs. Dispersed levels for Arsenic were 320 mg/kg with EFs of 10x, 471x, and 107x with respect to Recreational, Residential, and Industrial SLs. All other chemical parameters at the Dispersed site fell below screening levels.

Streamlined Ecological Risk Assessment (SLERA) for Iron City features:

Ecological Screening Values (ESVs) for the Iron City Waste Dump, Roadside, and Dispersed Area can be seen and referenced in Table 5.17 through Table 5.22. Snapshots of these tables are also included in this section

to help facilitate the description of methodology. The four primary terrestrial receptor groups used in development of ecological risk evaluations are terrestrial plants, soil invertebrates, birds, and mammals. Plants and invertebrates represent community-level organisms that are assumed to be exposed to mining impacted soils through direct contact. Birds and mammals would forage in the vicinity of habitats surrounding the Site. These receptor groups help break down data for comparison of published ecological screening values (ESVs) within each group. This section goes on to use commonly used contaminants of potential ecological concern (COPECs) to calculate Hazard Quotient (HQ) values for each parameter. These COPECs corresponded to maximum Exposure Point Concentrations (EPCs) for each analyte that were used to calculate HQ values by dividing max EPC by the most conservative, or "no-effect" ESV (HQ=max EPC/ESV). Analytes with an HQ greater than 1 were designated in excess and warranted further evaluation. The soil no-effect ESVs for this study have been generated from several standard sources, and are commonly used for remedial decisions at Superfund, and other hazardous waste sites (Table 5.1). For example, the screening values used in this study were gathered from the following sources:

- EPA's Ecological Soil Screening Levels (EcoSSLs)
  https://www. Epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents
- Los Alamos National Laboratory (LANL) no-effect ecological screening levels.
  https://lanl.gove/environment/protection/eco-risk-assessment.php
- EPA Region 4 soil screening values for hazardous waste sites.
  https://www.epa.gov/risk/region-4-ecological-risk-assessment-supplemental-guidance
- Oak Ridge National Laboratory (ORNL). Preliminary remediation goals for ecological endpoints.
  https://rais.ornl.gov/guidance/tm.html

A reminder that the most conservative (lowest) ESV is chosen for each analyte from the four receptor groups. This varies between analyte and receptor group. For example, arsenic is most detrimental to invertebrates as concentration increases so it is assigned the lowest ESV of the four receptor groups. Because of its low score, it is prioritized as the driving COPEC ESV throughout the study. Also, aluminum and iron do have ESVs, but they are not discussed as part of this study because they are highly dependent on soil pH. Birds and plants are systematically the most at risk of the four terrestrial receptor groups, followed by invertebrates and mammals. It should also be noted that this evaluation of ecological risk might differ than past investigations performed in PCS or PA/SI. TU feels that the level of detail associated with this version of assessment relates best to other Superfund evaluations going on concurrently in this Region and at other applicable sites. While some of the data interpretation is similar to the PA/SI, some aspects of HQ and total risk present the data in a more simplified and digestible manner.

Table 5.1.1: Soil No-Effect ESVs for the four terrestrial ecological receptor groups

Soil No-effect Ecological Screening Values (mg/kg)									COPEC Selection
Analyte	**Plants**	**Source**	**Invertebrates**	**Source**	**Birds**	**Source**	**Mammals**	**Source**	
Aluminum	--	a	--	a	--		--		--
Arsenic	18	a	6.8	b	43		46	a	6.8
Cadmium	32	a	140	a	0.77	a	0.36	a	0.36
Chromium	--		0.4	d	26	a	34	a	0.4
Copper	70	a	80	a	28	a	49	a	28
Iron	--	a		a	--		--		
Lead	120	a	1700	a	11	a	56	a	11
Manganese	220	a	450	a	4300	a	4000	a	220
Nickel	38	a	280	a	210	a	130	a	38
Selenium	0.52	a	4.1	a	1.2	a	0.63	a	0.52
Silver	560	b	--		4.2	a	14	a	4.2
Zinc	160	a	120	a	46	a	79	a	46

To align with concurrent analyses occurring in the Region, TU staff have referenced the Terrestrial Screening Level Ecological Risk Assessment (SLERA) completed for the Bonita Peak Mining District Superfund site in Colorado throughout this Section. Because Bonita Peak is one of the more recent, and highly contentious Superfund Sites, TU staff felt it pertinent to compare study results to baseline parameters of the SLERA for relative perspective. The EPA SLERA utilized a process that begins with identifying the maximum analyte concentrations at each Iron City feature in relation to the no-effect ESV of each analyte. The max detected concentration of each analyte was divided by the corresponding minimum soil ESV (Table 5.2). While this was performed for each Iron City feature, the Iron City Waste Dump is provided as an example in Table 5.2. Any resulting HQ > 1 was then considered a COPEC as Y (yes) or N (no). Every parameter with a soil ESV or relevant maximum concentration qualified as a soil COPEC besides Nickel for the Iron City Wast Dump dataset. Iron City Roadside and Dispersed datasets included the same COPECs as the Waste Dump with the exception of manganese in addition to Nickel.

Table 5.1.2: Hazard quotient and soil COPEC calculations for each parameter analyzed. This evaluates max values at the Iron City Waste Dump site. Any HQ > 1 were considered a soil COPEC.

Terrestrial Screening Values - Iron City Waste Dump				
Analyte	**Max Detected (mg/kg)**	**Soil ESV mg/kg**	**HQ**	**Soil COPEC?**
Aluminum	17800	--	NA	NA
Arsenic	1,480	6.8	217.6	Y
Cadmium	--	0.36	--	NA
Chromium	3	0.4	7.5	Y
Copper	3,280	28	117.1	Y
Iron	19,300	--	NA	NA
Lead	1,360	11	123.6	Y
Manganese	244	220	1.1	Y
Nickel	1.3	38	0.0	N
Selenium	--	0.52	--	NA
Silver	28.1	4.2	6.7	Y
Zinc	292	46	6.3	Y

A further breakdown of maximum HQs per terrestrial receptor group at the Waste Dump feature showed that arsenic was the main risk driver with a HQ sum of 366.5, which corresponds to 44% of the total risk of the metals present (Table 5.3). Of the four receptor groups, the invertebrate community has the largest potential to be negatively affected by the high arsenic concentrations as shown by the high associated HQ. The high arsenic values could correlate to past historic reports and geology of the area if the associated veins of material had high density of arsenopyrite in the host rock. Arsenic was followed by Copper with regards to total risk, which represented 33% for maximum concentrations with a correlating total HQ of 271.9. Ranking third on the HQ analysis was lead with a total HQ of 160.1 and 19% of the total risk. All other analytes were either 2% or lower rendering arsenic, copper, and lead the main risk drivers for terrestrial receptor groups at the Iron City Waste Dump feature.

Table 5.1.3: Shows a breakdown of MAXIMUM HQ values at the Iron City Waste Dump within each terrestrial receptor group, as well as a sum of each parameter to show priority. This Table is also appended as Table 5.18.

Iron City Waste Dump - Maximum HQs							
Analyte	**Max Detected (mg/kg)**	**Plants**	**Invertebrates**	**Birds**	**Mammals**	**HQ sum**	**% total Risk**
Aluminum	17800	NA	NA	NA	NA	0.0	0%
Arsenic	**1480**	**82.2**	**217.6**	**34.4**	**32.2**	**366.5**	**44%**
Cadmium	0	0.0	0.0	0.0	0.0	0.0	0%
Chromium	3	NA	7.5	0.1	0.1	7.7	0.9%
Copper	**3280**	**46.9**	**41.0**	**117.1**	**66.9**	**271.9**	**33%**
Iron	19300	NA	NA	NA	NA	0.0	0%
Lead	**1360**	**11.3**	**0.8**	**123.6**	**24.3**	**160.1**	**19%**
Manganese	244	1.1	0.5	0.1	0.1	1.8	0%
Nickel	1.26	0.0	0.0	0.0	0.0	0.1	0%
Selenium	5.62	NA	NA	NA	NA	0.0	0%
Silver	28.1	0.1	NA	6.7	2.0	8.7	1%
Zinc	292	1.8	2.4	6.3	3.7	14.3	2%
					Total Risk	831.0	100%

The corresponding Tables reference soil COPECs and maximum hazard quotients for Iron City Waste Dump. In-text tables can also be found in the Appended Table Section. Appended tables can be referenced when summarizing the results of the ecological risk for the remainder of the Iron City features.

Iron City Roadside results can be seen in appended *Table 5.19* and *Table 5.20* and are summarized below in a similar manner as the Iron City Waste Rock feature as discussed above. This feature showed that arsenic was the main risk driver with a HQ sum of 555.4, which corresponds to 52% of the total risk of the metals present. Of the four receptor groups, the plant community has the largest potential to be negatively affected by the high arsenic concentrations as shown by the high associated HQ. Arsenic was followed by copper with regards to total risk, which represented 29% for maximum concentrations with a correlating total HQ of 311.7. Ranking third on the HQ analysis was lead with a total HQ of 183.1 and 17% of the total risk. All other analytes were either 1% or lower rendering arsenic, copper, and lead the main risk drivers for terrestrial receptor groups at the Iron City Roadside feature.

Iron City Dispersed results can be seen in appended *Table 5.21* and *Table 5.22* and are summarized below in a similar manner as the Iron City Waste Rock feature discussed earlier in this Section. The Iron City Dispersed soils show that arsenic was the main risk driver with a HQ sum of 366.5, which corresponds to 52% of the total risk of the metals present. Of the four receptor groups, the invertebrate community has the largest potential to be negatively affected by the high arsenic concentrations as shown by the high associated HQ. Arsenic was followed by Lead regarding total risk, which represented 23% for maximum concentrations with a correlating total HQ of 160.1. Ranking third on the HQ analysis was Copper, with a total HQ of 154.8 and 22% of the total risk. All other analytes were either 2% or lower rendering arsenic, lead and copper the main risk drivers for terrestrial receptor groups at the Iron City Dispersed feature. The Iron City Dispersed feature was the only site that ranked lead slightly higher than Copper as the second COPEC. Iron City Waste Rock and Roadside ranked Arsenic first followed by Copper and Lead. However, these three analyses show that the same COPECs are negatively affecting ecological receptor groups at all three features of the Iron City Site.

Auburn Wetland soil results can be seen in appended *Table 5.22* summarizing Terrestrial ESVs compared to the maximum HQ. Arsenic concentrations have of 90.6 is two times the natural background (EPA PCS), with

an HQ of 22.4 or 20.7% of the total risk of metals present. Chromium concentrations in Auburn Wetland soils represent an HQ of 39.8% and a total rise of 36.8% of metals present. Copper concentrations have an HQ of 14.7 and total risk of 13.6% of metals present. Lastly, Lead concentrations found in Auburn Wetland soils have an HQ of 25.8 and represent 23.8% of the risk based on metals detected at this feature.

5.2.3 Iron City SPLP Results

In addition to terrestrial screening values, TU applied the analytical Synthetic Precipitation Leachate Procedure (SPLP) results to the National Oceanic and Atmospheric Administration (NOAA) precipitation frequency (PF) estimates to calculate the maximum metals load from the Iron City Site during various scenarios of precipitation. PF values were generated from Idarado Station (site 55-0538). The PF values presented by NOAA have a 90% confidence interval; total precipitation based on PF values is presented as Intensity (in/hr). TU's calculation methods are outlined here:

Notes and Assumptions:
- Rational method was selected because drainage area (Ad) < 1-2 square miles (0.32 sq. mi)
- Calculation performed using Ad of 1.02 acres (Iron City Area)
- 100- and 500-year 2-hour PF values - "C" value of 0.2 assumed for unimproved forested land at slopes greater than 6% per attachment - Qp (cfs) denoted flow/discharge measured from NOAA PF

$$Qp = C*I*Ad$$

Calculated intensity based on time of concentration (Tc)	
Sheet flow Tc (min)	120
Shallow flow Tc (min)	11.8
Channel flow Tc (min)	8.1
Total Tc (min)	**139.9**

$$I = \frac{28.5 * P}{(10 + Tc)^{.786}}$$

100-year Event

C	0.20
Ad (acres)	1.02
Ad (sq ft)	44,431.2
PF (1 hour in inches)	1.80
Intensity (in/hr)	0.9999
Qp (cfs)	**0.20**

500-year Event

C	0.29
Ad (acres)	1.02
Ad (sq ft)	44,431.2
PF (1 hour in inches)	2.52
Intensity (in/hr)	1.3998
Qp (cfs)	**0.29**

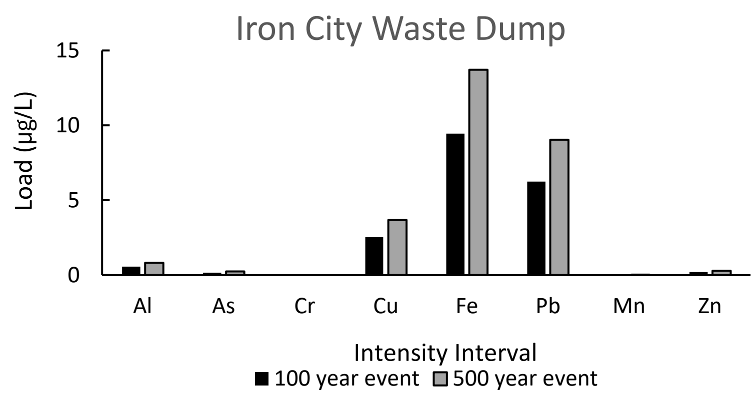

Figure 5.1: Represents the loading potential for the eight RCRA metals, based on maximum SPLP leachate concentrations at the Iron City Site, using site-specific Precipitation Frequency values for 2-hour loading event.

Because an SPLP extraction is based on a two-hour event to represent the leachability of a site's material via natural weathering, oftentimes, SPLP concentrations are compared to EPA drinking water supply maximum detection limits (MDLs); however, in the case of the Red Mountain TOS sites, the AOCs are not in proximity to drinking water wells or municipal drinking water supply intakes. For this reason, TU adapted a calculation to illustrate the loading potential of the Iron City Site in a 100-year and 500-year rain event.

Loading potential was calculated using an Iron City site footprint of 1.02 acres or 44,431 square feet, which encompasses all three AOCs. Based on that surface area, A 100-year rain event for 120 minutes (2 hours) would produce .9999 inches of rain per hour, which equates to roughly 0.20 CFS or 75 gallons per minute (gpm). The 500-year rain event projects a maximum of 1.398 inches of rain per hour, equating to 0.29 CFS or 108 gpm. This calculation assumes flow across the 1.02 acres is directed into a confined flow path. This is relevant to the Iron City site as there is evidence of a stormwater flow path that originates from Corkscrew Road, flowing down to and along the toe of the Waste Dump pile before flowing into the unconfined area of the Dispersed Site.

The importance of the hydrologic calculations is that it reveals the capacity of the Iron City site to load metals to Corkscrew Gulch via leaching. The results of the SPLP calculation indicate that chromium, copper, iron, and lead are the constituents of concern in loading Corkscrew Gulch during high-intensity rain events. Appended Table 5.25 shows that the Iron City Roadside is the AOC that has the highest maximum leachability.

*AGP and SPLP loading calculation are not presented for the Auburn Mine waste pile; AGP laboratory analytics were not included in the PA/SI.

5.2.4 Auburn Wetland SPLP Results

100-year Event

C	0.20
Ad (acres)	0.82
Ad (sq ft)	35,719
PF (1 hour in inches)	1.80
Intensity (ft/hr)	0.9999
Qp (cfs)	**0.16**

500-year Event

C	0.20
Ad (acres)	0.82
Ad (sq ft)	35719.2
PF (1 hour in inches)	2.52
Intensity (ft/hr)	1.3998
Qp (cfs)	**0.23**

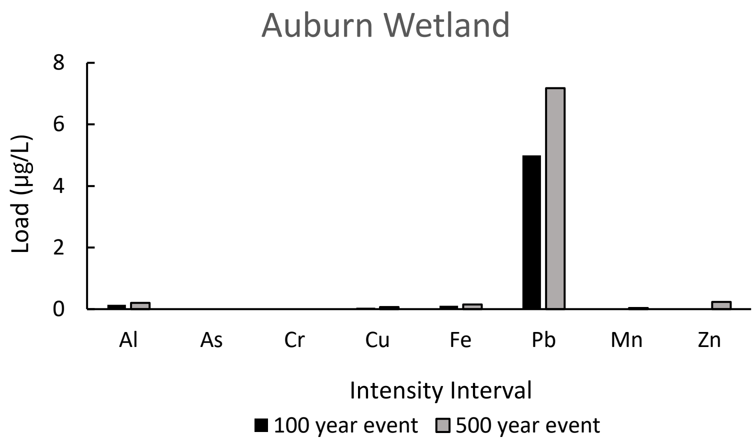

Figure 5.2: Represents the loading potential for the eight RCRA metals, based on maximum SPLP leachate concentrations at the Auburn Wetland using site-specific Precipitation Frequency values for 2-hour loading event. Based on the SPLP calculations, lead has the potential to leach from the site from natural weathering. The data presented in appended Table 5.24 and Figure 5.2 represent extreme rain events; however, it allows for an understanding of the leachability of soils through long-term weathering.

5.2.5 Acid Base Accounting

ACZ Laboratories conducted Acid Base Accounting (ABA) analysis for all soil, and sediment samples collected at the Auburn Wetland and Iron City AOCs, and results are provided in Table 5.2 and Appendix D.

Acid-Base Accounting (ABA) and total sulfur content were completed as part of the ACZ analysis for all of the site samples that were collected in 2021 (Auburn Wetland, Iron City Waste Dump, Iron City Roadside, Iron City Dispersed). In general, ABA is a screening procedure where the acid-generating potential (AGP) is compared to the sample's acid-neutralizing potential (ANP). The difference between the neutralizing and generating potentials is then considered the acid-base accounting potential. A negative value would mean that acid generation potential will be predominant when weathering of the material occurs. ABA is a qualitative measure for assessing the risk of acid generation and for indicating the relative margin of safety within a material or sample. The Neutralization Potential Ratio relates the AGP and the ANP. Standard classifications used when reviewing ABA are as follows:

Geochemical Material Type	NPR	ABA Potential
Potentially Acid Generating (PAG)	*≤1*	*<-20*
Uncertain	***1-2***	***-20 - +20***
Non-PAG	*≥2*	*>+20*

The USGS indicates that an ABA potential 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. An ABA potential of less than 20 but greater than -20 ma needs kinetic testing to evaluate further, as described in the categories above. It should be noted that the units for ABA potential are commonly reported in tons of $CaCO_3$ per kiloton of soil.

In addition, ABA provides an estimate of the 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. When looking at ABA and the amount of neutralization material needed to successfully buffer pH, consideration of treatability in-situ vs. consolidation and capping should be considered.

The Auburn Wetland composite sample *(appended Table 5.25*) yielded acid-generating conditions by exhibiting an ABA potential value of -38.4 t CaCO3/Kt. This value, combined with a pH of 3.3 and total sulfur content of 1.23% provides the potential for further weathering of heavy metals and generating acid mine drainage runoff during precipitation events. An ABA potential value of -38.4 correlates to 38.4 tons of CaCO3 per 1000 tons of soil, which broadly equates to 38.4 tons of CaCO3 over an acre at a six-inch depth required to neutralize that contaminated soil. Depending on hauling and budgetary constraints, in-situ treatment of this material could potentially be considered within removal action objectives.

The 2021 Iron City Waste dump composite sample (*appended Table 5.26*) yielded acid-generating conditions by exhibiting an ABA potential value of -40.6 t CaCO3/Kt. This value, combined with a pH of 3.9 and total sulfur content of 1.30%, provides the potential for further weathering heavy metals and generating acid mine drainage runoff during precipitation events. An ABA potential value of -40.6 correlates to 40.6 tons of CaCO3 per 1000 tons of soil, broadly equating to 40.6 tons of CaCO3 over an acre at a six-inch depth. Depending on hauling and budgetary constraints, in-situ treatment of this material could potentially be considered within removal action objectives.

The Iron City Roadside composite sample (*appended Table 5.27*) yields an incredibly high ABA potential value of -175 t CaCO3/Kt, corresponding to very acidic soil conditions. In addition to a low pH of 3.9 and total sulfur content of 5.59%, these conditions could produce hazardous acid mine drainage during precipitation events. This assumption is also validated through data summarized in Section 5.1.5, detailing Iron City Roadside material yielding the highest potential for metals loading during the 100- and 500-year precipitation events based on soil chemistry data. Therefore, this material should not be considered for in-situ treatment due to the amount of CaCO3 required to neutralize this material and the high percentage of total sulfur. The only solution to minimize the potential future weathering of sulfur and pyritic material will be to consolidate this material into a lined repository cell constructed on-site.

The Iron City Dispersed composite sample (*appended Table 5.28*) yielded acid-generating conditions by exhibiting an ABA potential value of -10.3 t CaCO3/Kt. This value, combined with a pH of 4.2 and total sulfur

content of 0.33%, provides the potential for further weathering heavy metals and generating acid mine drainage runoff during precipitation events. An ABA potential value of -10.3 correlates to 10.3 tons of CaCO3 per 1000 tons of soil, broadly equating to 10.3 tons of CaCO3 over an acre at a six-inch depth. Based on the sulfur content, soils at this feature are less acid-forming and qualify to be stabilized with acid-neutralizing in-situ amendments to improve soil conditions.

5.2.6 Data Summary and Conclusions

Soil data collected in 2019, 2020, and 2021 by the EPA, Applied Intellect, and TU allowed for priority ranking between sites using wet metals chemistry and in-situ treatability through a comparison of ABA and lime requirements. Based on the results of surface water analysis at the Auburn and soil analyses performed at the Auburn Mine, Auburn Wetland, and Iron City Sites, all AOCs exceed regulatory surface water or soil screening levels.

Site Summaries:

1. Auburn: Adit discharge has a pH of 2.09 at the portal and 2.16 at the toe of the waste dump. Metals concentrations exceed state water quality TVS standards for copper, zinc, cadmium, and lead. The Auburn waste dump soils exceed several screening levels for Recreational, Residential, and Industrial. The Auburn Waste Rock has an arsenic concentration of 300 mg/kg, which exceeds P&I by 17X and B&M by 7X. Copper concentrations are 393 mg/kg and exceed P&I and B&M by 5.6X and 14X, respectively, and lead concentrations of 520 mg/kg exceed P&I and B&M by 4.3X and 47X respectively.
2. Auburn Wetland: Arsenic exceeded Recreational, Residential, and Industrial SLs by 3, 133, and 30 times, respectively. Iron exceeded the EPA Residential SL by 3 times. ABA indicates that the Auburn Wetland has a moderate AGP, with a low saturated paste pH value of 3.3. The Auburn adit water makes its way down into the Auburn Wetland either through direct surface connection at certain points of the year or shallow groundwater flows. The adit water is elevated in copper, zinc, aluminum, cadmium, and lead with respect to TVS, and while these parameters do not exhibit soil concentrations in the wetland to affect Human Health, they pose risk to ecological receptors. For example, copper is 177 mg/kg in the Auburn Wetland soils which correlates to an exceedance of 3X, 2X, 6X, and 4X with respect to plant, invertebrate, bird, and mammals SLs. This copper value corresponds to 13.6% of the total risk to ecological receptors at the Auburn Wetland. In addition to arsenic and chromium that make up 20.7% and 36.8% of the total risk, respectively, the lead concentration of 120 mg/kg assumes 27.8% of the total ecological risk at the Auburn Wetland. Lead concentrations exceed ESVs for plant, bird, and mammal receptor groups, and make up 23.8% of the metals that present risk to terrestrial receptor groups. Selenium concentrations exceed ESVs for plant, bird, and mammal receptor groups. Therefore, a correlation between adit water and its deposition of metals into the Auburn Wetland can be inferred by the remaining risk to ecological receptors.
3. Iron City: The Roadside material contains arsenic that exceeds Recreational, Residential, and Industrial SLs by 159, 7176 and 1627 times, respectively, while lead exceeds Recreational, Residential, and Industrial SLs by 5, 10, and 5 times. The Waste Dump exceeds respective arsenic SLs by 48, 2176, 493 times, while lead exceeds SLs by 2, 3, and 2 times. Soils at the Dispersed feature exceed respective arsenic SLs by 10, 471, and 107 times. With regards to the SLERA, The Iron City Dispersed feature was the only site of the three Iron City AOCs that ranked lead slightly higher than Copper as the second COPEC. Iron City Waste Rock and Roadside ranked Arsenic first followed by Copper and Lead. However, these three analyses show that the same COPECs are

negatively affecting ecological receptor groups and maintain a majority of the total risk at all three features of the Iron City Site.

Section 6 – Identification of Removal Action Scope, Goals, and Objectives

The purpose of an EE/CA is to use preliminary assessment data and previous site investigations to inform the scope and objectives for a Removal Action. Based on past studies implemented in Corkscrew Gulch by the Colorado Geological Survey (CGS), the Colorado Department of Public Health and Environment (CDPHE), the USFS, the EPA, Applied Intellect, and Trout Unlimited; the multi-site EE/CA, which encapsulates the Auburn Mine, Auburn Wetland, and Iron City Mine, is being conducted as a Non-Time-Critical Removal Action (NTCRA). In general, the scope 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.

As stated prior in this document, the specific primary removal factors that pertain to this project and scope of work are I, IV, and V which are reiterated below along with project-specific justification:

- (i) Actual/potential exposure to humans or animals or food chain.
  - Given the OHV increased use in the area and public bathroom in close proximity to the site, the potential for humans to interact with contaminated mine waste and water is a concern. There is also an ecological and continual exposure/ingestion risk to animals that are in the area;
- (iv) High levels of hazardous substances, pollutants, or contaminants in surface soils that may migrate.
  - Mass wasting and erosion of mine wastes and tailings is visibly evident at all sites;
- (v) Weather conditions (avalanches and storm events) may cause hazardous substances or pollutants/contaminants to migrate or be released.
  - Migration of contaminated material from these sites has been caused by years of weathering and increased frequency of high flow and precipitation events linked with climate change. Monsoonal events at this elevation are also of concern to continually mobilize fine-grained materials downslope.

By completing removal actions focusing on the above factors, partners anticipate the following benefits:

- Stabilization of contaminated material on-site while reducing the ability of that material to migrate or be mobilized off-site;
- Improvement of surrounding environmental conditions and downstream water quality;
- Reduce potential risks to the environment (ecological and aquatic receptors) and humans from exposure to mine wastes at the Site;
- Control runoff from mine waste and minimize erosion; and
- Create a stable, native vegetative cover across the Site that resembles the surrounding area.

Section 7 – Identification and Comparison of Removal Action Alternatives

This section identifies field techniques to address the aforementioned AOCs and presents an analysis of the selected removal action alternatives.

Due to the nature of the AOCs, COPCs/COPECs, and site location (access, elevation, and steep grade), a limited number of alternatives are associated with this analysis of alternatives. Alternatives presented in this section will not absolve the AOCs of contaminated material; however, AML best management practices (BMPs) feasible to employ at this site can help stabilize heavy metals in soils through chemical bonding and reduce their availability to groundwater and other pathways. The main removal action goal will be to reduce the toxicity by stabilizing metallic minerals while preventing the migration of contaminated material

to offsite receptors. The removal action alternatives address the waste rock piles and associated metals contamination present at the Auburn and Iron City Mines.

7.1 Description of Removal Action Technologies

This section identifies applicable technologies based on site conditions and COPCs/COPECs. 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 combination during the evaluation of the removal action alternatives:

- On-site Repository; and
- Off-site Disposal; and
- Cap/Cover in Place; and
- Surface Controls; and
- Institutional Controls; and
- In-situ Stabilization

7.1.1 On-Site Repository

An on-site repository is not designed to reduce the volume or treat hazardous materials. It is used to significantly reduce the human and ecological risk associated with exposure pathways such as ingestion, inhalation, and dermal contact. A repository is also very effective in preventing exposed materials and associated contamination from migrating off-site. On-site repositories can be used as a permanent source control measure. The repository design would depend primarily on the toxicity and mobility of the material requiring disposal. The process of constructing a repository generally involves excavating and placing the contaminated materials into an on-site engineered facility that may or may not utilize a liner system depending on the contamination of material.

Composite cover repositories reduce exposure pathways in two main techniques. One is to utilize an impermeable liner to prevent or reduce surface water infiltration or leaching of the contaminated material, and the other is a vegetated soil cap/cover that reduces infiltration while also stabilizing the reclaimed surface. These factors are important when COPCs/COPECs are mobile and in areas where groundwater may be affected. In this case, a repository can significantly reduce the mobility of constituents of concern while also providing a protective barrier between the environment and the contaminated material. Often times, an impermeable liner made of composite material is typically recommended to fully encapsulate the consolidated material to reduce leaching to groundwater and percolation of any contaminated water. The cover system includes a low permeability layer and a protective layer. The protective layer usually consists of a vegetated topsoil layer designed to protect the low permeability layer that is beneath it, and to help reduce infiltration through evapotranspiration. In cases where contamination is not excessively high, and groundwater is not near the ground surface, a single protective layer may be appropriate.

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 bedrock and groundwater, slope stability), presence of cultural resources, biological factors (threatened, endangered, or sensitive species), and environmental factors (avalanche potential, disturbance areas, wetlands areas).

7.1.2 Off-Site Disposal

Given the potential constraints with working at high elevations with regards to on-site repository construction, off-site disposal should also be considered. 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 is why contaminated

materials are commonly hauled to a landfill or hazardous waste landfill facility. A benefit of this approach is that all contaminated material is removed from the site and cannot migrate or negatively affect receptor groups. The off-site disposal proposed in this EE/CA would be hauled to the closest landfill.

7.1.3 Capping in Place

Capping material in place involves grading existing waste piles to eliminate steep slopes, followed by covering the mine waste material with a protective native soil layer to reduce contaminant exposure and migration. It is used to reduce the human and ecological risk associated with exposure to contaminated sources. 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. In some instances, soil amendments are incorporated into the mine wastes prior to capping to help render them stabilized or unavailable during the weathering process.

7.1.4 Surface Controls

Surface Controls are used to reduce contaminant mobility; however, surface controls alone may not be appropriate in areas where direct human and ecological contact is a primary concern. In these instances, surface controls can be integrated with other technologies to reduce the likelihood of human and ecological contact with contaminated material. 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 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. Proper grading can be an effective low-cost solution to minimize the mobility of mineralized soils. Final grade should reflect natural site conditions, but account for the desired outcome of stabilizing material. Selecting areas with established vegetation as outlets for constructed drainage will help capture sediments while minimizing erosion. The addition of seed mixtures that account for elevation, length of growing season, and local flora will encourage higher germination rates and annual succession to reduce erosion potential after grading activities.

Vegetation may involve adding soil amendments to a specific depth to provide nutrients and organic materials for enhancing vegetation growth. At a minimum, selecting the appropriate plant species, preparing 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 soil's water storage capacity may also be required (see In-Situ Phytostabilization below). 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 includes using erosion-resistant materials to control and reduce erosional effects at the surface. Typical erosion protection applications involve installing natural or synthetic fabric mats, straw waddles, riprap, wood straw, agricultural straw, earthen berms along slopes, or surface water diversion structures. The use of synthetic materials has decreased over the years as biodegradable fabrics such a jute and bamboo have been developed to reduce impacts to the surrounding landscape.

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

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. Surface water controls will also be instituted on Corkscrew Road due to the extent of erosion.

Institutional Controls are administrative and/or legal controls that help minimize risk and/or protect the integrity of remediation by limiting future land use or preventing access to the site. Applicable examples for use of the Site are wood buck and rail structures and USFS signs to discourage use of the Sites. While such controls may not effectively achieve cleanup goals, they are often augmented with other removal alternatives.

In-situ Phytostabilization is a method of reclamation that uses various amendments at calculated rates to improve soil conditions and reduce contamination. Frequently used amendments include limestone, lime, magnesium oxide (lead reduction), compost, fertilizers, biochar, manure, and other local materials. Each amendment has a specific use, and each site is different, making preconstruction sampling and analyses very important. In-situ methods do not remove COPCs/COPECs from a site, but reduce their bioavailability by increasing vegetative cover, and improving conditions for naturally occurring bacteria and fungi that can metabolize metals. Combining that amendment with fertilizer and compost offers a good approach to improving the growing medium of soils on-site.

Road Construction can be a necessary removal action construction step for sites where access has deteriorated or was never established if ore was transported via tramways. In these instances, road construction may be necessary to reclaim materials and reduce human and environmental threats. I

7.1 Removal Action Alternatives

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 in the existing footprint of mine-impacted soils;
- Repository construction adjacent to mine-impacted materials;
- Construction of a material conveyance structure coupled with the on-site repository;
- Off-site disposal;

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 developing and assembling the removal action alternatives.

- Alternative 1 – On-site repository, surface water controls, in-situ soil amendments, site revegetation, rock cap of Auburn
- Alternative 2 – Repository Adjacent to mine-impacted soils, surface water controls, in-situ soil amendments, site revegetation, rock cap of Auburn
- Alternative 3 – On-site repository of <u>all</u> mine-impacted soils, cap and cover, surface water controls, in-situ soil amendments, site revegetation
- Alternative 4 – Off-site disposal, surface water controls, revegetation
- Alternative 5 – No Action

The "No Action" alternative is included in this EE/CA to form a comparison to all other proposed removal action measures. As suggested, this alternative does not include any reclamation or remediation steps, and selection of this alternative would result in no net changes to the current site conditions.

All of the proposed Alternatives will feature similar field methods to complete the removal action. Those field methods include in-situ soil amendments, surface water controls, and site revegetation. Regardless of the selected, these field methods will be utilized. To reduce the amount of repeated subtext through Section 7, those field methods are summarized here:

Repository Construction

Based on the exceedances measured at various site locations, proposed repository locations in each alternative may differ. What will remain consistent is the construction plan for any of the proposed on-site repository locations.

Repository construction is based on parameters such as, total metals concentrations, acid generating potential (AGP) and SPLP leachability values from laboratory measurement of soil from each site feature. Soils originate from the Auburn Waste Dump, the Auburn Wetland, the Iron City Roadside, the Iron City Waste Dump, and the Iron City Dispersed sites. The following two approaches provide examples that will house the Iron City Roadside material and the remainder of all other waste on-site.

AGP values from the Iron City Roadside are extremely high and cannot be neutralized via in-situ amendment prescriptions. For this reason, these materials should be excavated from their current footprint and consolidated into a fully enclosed impermeable membrane/liner. The amount of material estimated at this site is estimated at 622 cubic yards (CY). Material should be excavated to native soils and placed in its own full-lined repository. While the estimated volume of Roadside material is 622 CY, this feature should be sized large enough to potentially house 764 CY of contaminated material that would allow a factor of safety and consider a minimum soil bulking factor of 15%. Consideration of bedding material should be factored into construction to minimize potential puncture of liner once material is placed in compacted lifts. Large angular boulders should be placed in buttress format at the toe of slope where Roadside materials are removed. Native soils generated from the construction of the repository should be used to backfill the former footprint of the Roadside feature and to attain grade up to the toe-slope buttress.

For the remainder of metal-laden soil to be placed in an on-site repository, TU recommends use of an impermeable liner beneath an adequate depth of native soil cap. So long as the impermeable liner is buried under several feet of clean native soils, the long-term degradation of a geosynthetic clay liner (GCL) or equivalent liner is not a chief concern. Moreover, due to the residence time of seasonal snowpack at the

Site, seasonal infiltration and groundwater exchange is probable. To reduce that exchange, an impermeable liner capping the top of the consolidated material is recommended for remaining on-site waste. A final measure for the on-site repository will be a soil cap/cover. The soil cap should be comprised of clean material generated on-site and should average a depth of 2 feet. Adequate soil depths will ensure vegetative recruitment and long-term stability of the feature while also providing resistance to the extreme weather patterns this site experiences. Proper site grading will also reduce infiltration; final construction phases should include grading the repository footprint to match existing slopes.

In-Situ Soil Amendments

The material in the Iron City Dispersed feature is the most benign of contaminants located at the Iron City site, with slight exceedance of total arsenic concentrations. ABA indicates that relatively low limestone rates will neutralize soil acidity. Additional BMP soil amendments should be prescribed to increase the percentage of organics. Using biochar and peat moss will increase bioavailable carbon and support moisture retention in soils to promote vegetative health. An adequate depth of amendment incorporation for best results and long-term site health is recommended at 18 to 24 inches. The leachability of metals from the Dispersed soil samples is relatively low, so remediation of this feature should not be at the surface—soil neutralization and moisture retention several feet deep increase the likelihood that vegetation can attain target rooting depth.

Every Alternative includes in-situ amendment incorporation for the 0.82-acre Auburn Wetland. Because of the low soil pH of 3.3 and an AGP of 7.5, TU recommends using limestone to buffer and improve soil pH. The addition of limestone in the form of pulverized or crusher fines should be incorporated to neutralize pH and provide a soil condition that can be amended with organics to support high elevation native vegetation.

In addition to limestone, TU proposes adding a 4-6-2, Biotic Earth, native seed, and mulch to the reclaimed surface to increase organic composition and moisture retention capacity to improve growing conditions. The 4-6-2 product consists of biochar, mycorrhizae, and humates that are essential to soil health.

Surface Water Controls

For the Auburn Waste Dump, the flow measured during the EPA PCS was 3.23 gpm and the PA/SI was 22.44 gpm provided a bit of discrepancy. However, based on the above catchment area and high elevation of the basin, a relatively average adit discharge of 12.8 is assumed when considering these two flow rates. A surface water channel should be constructed to direct adit discharge surface flows around the Auburn waste dump to the adjacent talus slope.

For the Iron City Site, surface water controls should be built to encompass the uphill margin of the waste dump and reduce the long-term weathering of material on-site. A branch of the channel should extend up to Corkscrew Gulch Road where erosion has caused significant downcutting; adjoin the surface water channel that skirts the periphery of the waste dump footprint; and then extend into the Dispersed footprint where a large attenuation area dissipates surface water flows. The attenuation fan should be built at the perimeter permitter of the site footprint (Figure 9). Boulders should be used as check structures to step this channel down and reduce downcutting to this channel. Channel dimensions should mimic state and federal reclamation BMPs.

In addition to surface water controls to circumnavigate all of the AOCs, TU recommends road maintenance to Corkscrew Pass Road, immediately upslope of the Iron City Mine and adjacent to the Iron City Roadside material. According to GMUG Transportation Engineering staff, this should include no less than two rolling dips built to USFS specifications. Further, the portion of Corkscrew Gulch Road between the rolling dips

should be insloped at a 4-6% grade to convey surface flow away from the road edge and into the rolling dips.

Road Improvements

Corkscrew Pass currently exudes high priority maintenance needs. TU and USFS concluded this need is due to natural material weathering and steep topography coupled with consistent seasonal recreational use. To thwart impacts of road failures to the Removal Action site, road improvements should be executed regardless of the Alternative chosen.

USFS transportation staff outlined that road improvements need to include construction of no less than two rolling dips, built to specifications required by the USFS. Additionally, proper drainage needs to be constructed by reshaping the portion of the road between rolling dip structures to an inslope of 4-6% to adequately convey surface waters between features. Major erosion is occurring at the fill slope between the road and the Iron City Waste Dump; reconstruction of this fill slope should also be conducted.

Site Revegetation

A final step to the proposed Alternatives in the EE/CA will be revegetation measures. In order to adequately stabilize on-site construction measures, proper execution of revegetation measures will be critical. Due to the slopes presented at the Iron City and Auburn, on-site seeding will be limited to “broadcast” methods, where seed is spread via a hopper or mechanism to control seeding rates. TU recommends seed rates of no less than 25 pounds per acre. Seeding should be coupled with installation of biodegradable erosion control measures where slopes present risk of forming rills or gullies.

Revegetation measures of the Auburn Wetland feature should include proper incorporation of soil amendments to neutralize pH and provide proper organic content to support target plant species. Transplanting sod mats from the perimeter of the existing wetland feature or nearby feature may be a viable option to expedite site plant succession.

7.1.1 Alternative 1: On-site Repository In-place, Surface Water Controls, In-situ Soil Amendments, Rock Cap of Auburn

Under this Alternative, the amendment applications and construction will focus on the reclamation of Iron City Waste Dump and surface material associated with the Dispersed feature. These materials would be placed into on an on-site repository constructed within the existing impacted footprint of the Iron City Waste Dump. The Iron City Roadside would also be consolidated into the existing Iron City Waste Dump repository as its own fully encapsulated and lined cell. The other repository cell would house the Iron City Waste Dump and Dispersed materials. These repository features are also summarized in Section 7.1. The goal of this Alternative is to consolidate Iron City features within their current relative footprint and to reduce disturbance during the removal actions. Moreover, this Alternative presents a partial removal approach, where the most accessible materials are consolidated and buried within the on-site repository, and the hard-to-reach material from the Auburn is capped to decrease material weathering and mobilization and risk to human or environmental receptors.

Alternative 1 repository will not house materials from the Auburn Mine. The Auburn Waste Dump will be graded and capped with rock generated from areas adjacent to this feature. This work would be done with an excavator to have minimal impact on the area. Under this Alternative, exposed waste rock at the Auburn Waste Dump would be reshaped and blended into the adjacent slope as best as possible. Once the pile has been reshaped, it should be capped with local material (talus, rock, riprap) adjacent to the feature. Reclamation would for this portion would include installation of surface water controls to reroute adit discharge around the existing waste rock pile, reducing metals precipitation.

This Alternative would also include in-situ amendment applications to the Auburn Wetland and Iron City Dispersed materials to neutralize soil pH and provide a soil medium that promotes revegetation and long-term soil stability. Aspects of this revegetation should also include rough grading of amended soils to break up sheet and surface flows that continue to erode and mobilize material off site. In-situ amendments prescriptions should be concluded in the post-EE/CA design phase.

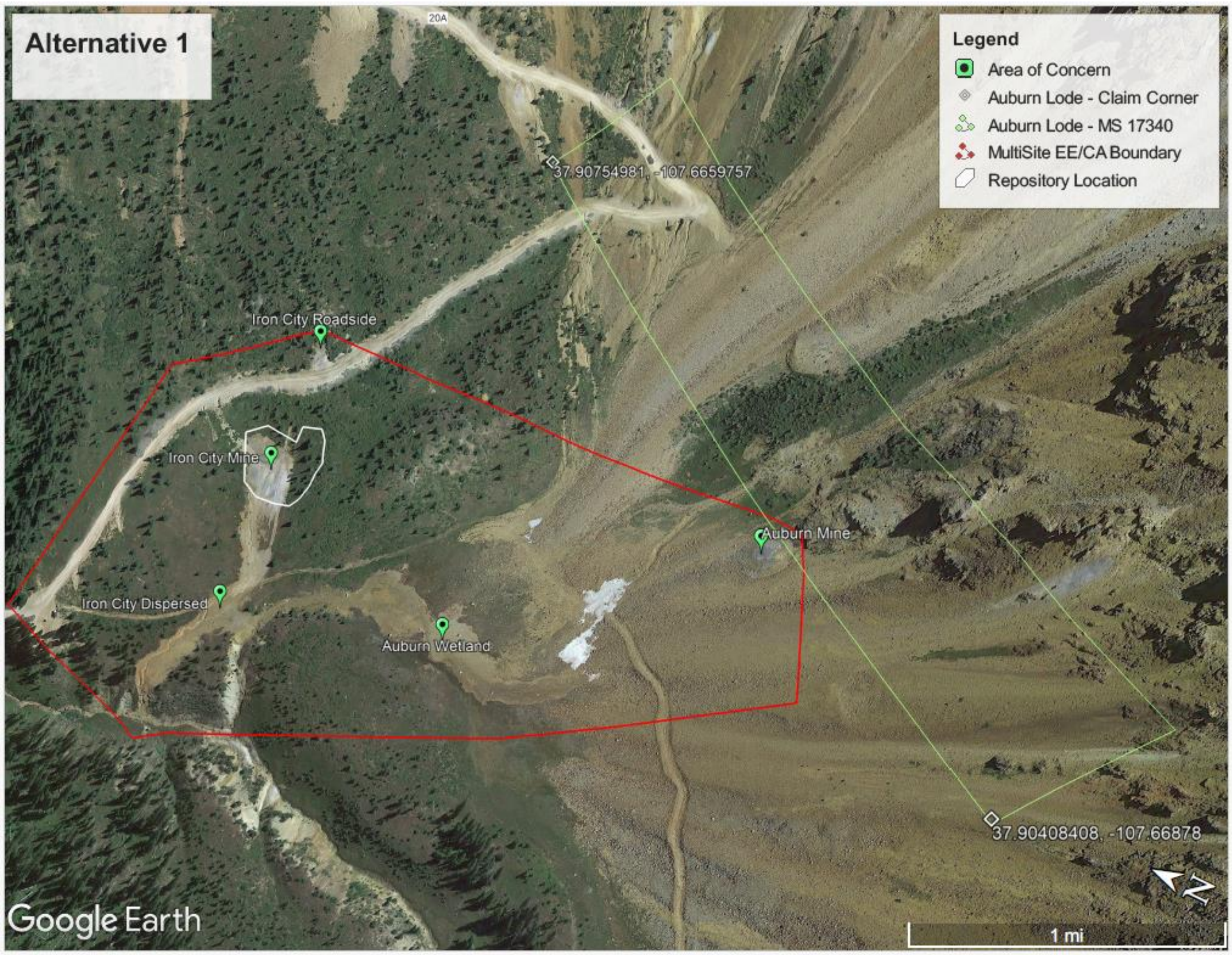

Figure 12: Alternative 1 Repository Location **(white polygon)**

To accomplish the Removal Action scope of this Alternative, on-site rock and soil borrow locations will need to be identified and established at both the Iron City and Auburn during reclamation. The EE/CA perimeter shown in Figure 12 is 15-acres. Mine-impacted portions of the Site make up an estimated 3.7-acres.

7.1.2 Alternative 2: Repository Adjacent to Mine-impacted Footprint, In-situ Amendments & Revegetation, Diversions, Rock Cap of Auburn

The defining difference in this Removal Action Alternative is the construction of a repository adjacent to mining impacted areas delineated at the site. As mentioned, AOCs make up 3.7-acres, of upper Corkscrew Gulch, which accounts for all Iron City and Auburn Mine features.

To present a comprehensive assessment approach to all proposed removal actions, Alternative 2 includes construction of a standalone repository at a location composed of all native soils, adjacent to mine-impacted areas. Based on site surveys and field observations, the location of the repository would need to

be located adjacent to the Iron City Waste Dump. This site was determined based on existing topography and feasibility of construction. Figure 13 illustrates two proposed repository locations; one situated to the north of the Iron City Waste Dump and one situated south of this feature. Construction of the north repository is more feasible based on topography and would also reduce the number of woody tree species to be removed. Each repository location supports native high-alpine flora and fauna.

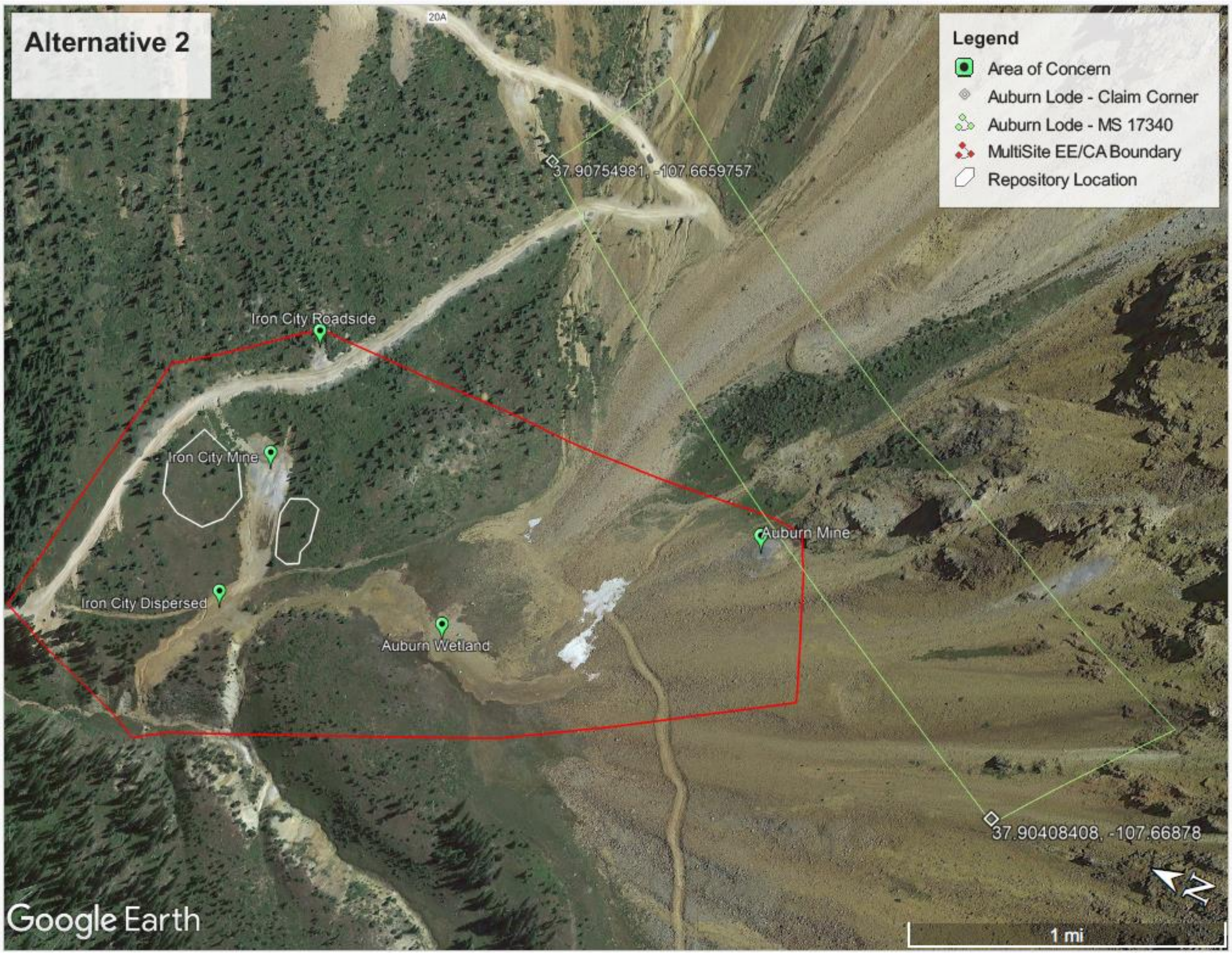

Figure 13: Alternative 2 Proposed Repository Location **(white polygons)**

The repository locations shown in Figure 13 are an approximate location and size and will need to be further defined in future design phases. However, the repository should be sized to accommodate a minimum of 4,875 cubic yards of mine waste from the Iron City Mine. As in Alternative 1, the Roadside material needs to be excavated, hauled, and placed in its own fully enclosed and impermeable-lined cell that could be incorporated into the overall repository of this Alternative. This cell could also be constructed adjacent as a standalone feature.

The Alternative 2 repository will not house materials from the Auburn Mine. The Auburn Waste Dump will be graded and capped with rock generated from areas adjacent to this feature. This work would be done with an excavator to have minimal impact on the area.

7.1.3 Alternative 3: On-Site Repository of ALL Mine-Impacted Soils, Cap and Cover, Surface Water Controls, Revegetation

This removal action entails the most extensive on-site work to consolidate materials. Surface water controls, in-situ soil amendments, and revegetation are the same for this Alternative, as is presented in Alternative 1 and 2. The major difference with Alternative 3, is the Auburn Waste Dump materials would all be consolidated into the on-site repository within the Iron City Waste Dump feature. The Alternative 3 repository will match Alternative 1 in the fact that it will take up the footprint of the Iron City Mine. Due to the increase in material to be consolidated from the Auburn Mine under this Alternative (5,765 CY vs. 4,875 CY Alt 1 / 2), additional repository space will be needed to accommodate the additional material. This additional repository area will be located to the south and would adjoin the repository the location proposed in Alternative 2 (Figure 14). Under this Alternative, it is assumed that all material will be consolidated into one large repository that takes up the aerial footprint of the two polygons shown in Figure 14. Corkscrew Gulch Road above the Iron City Waste Dump will be improved to shed surface water flows up and downslope of the repository. The location of the repositories was selected based on site topography. Proposed locations will be out of surface water pathways. Surface water controls above and adjacent to the repository locations will shed intermittent surface flows during snowmelt and precipitation events.

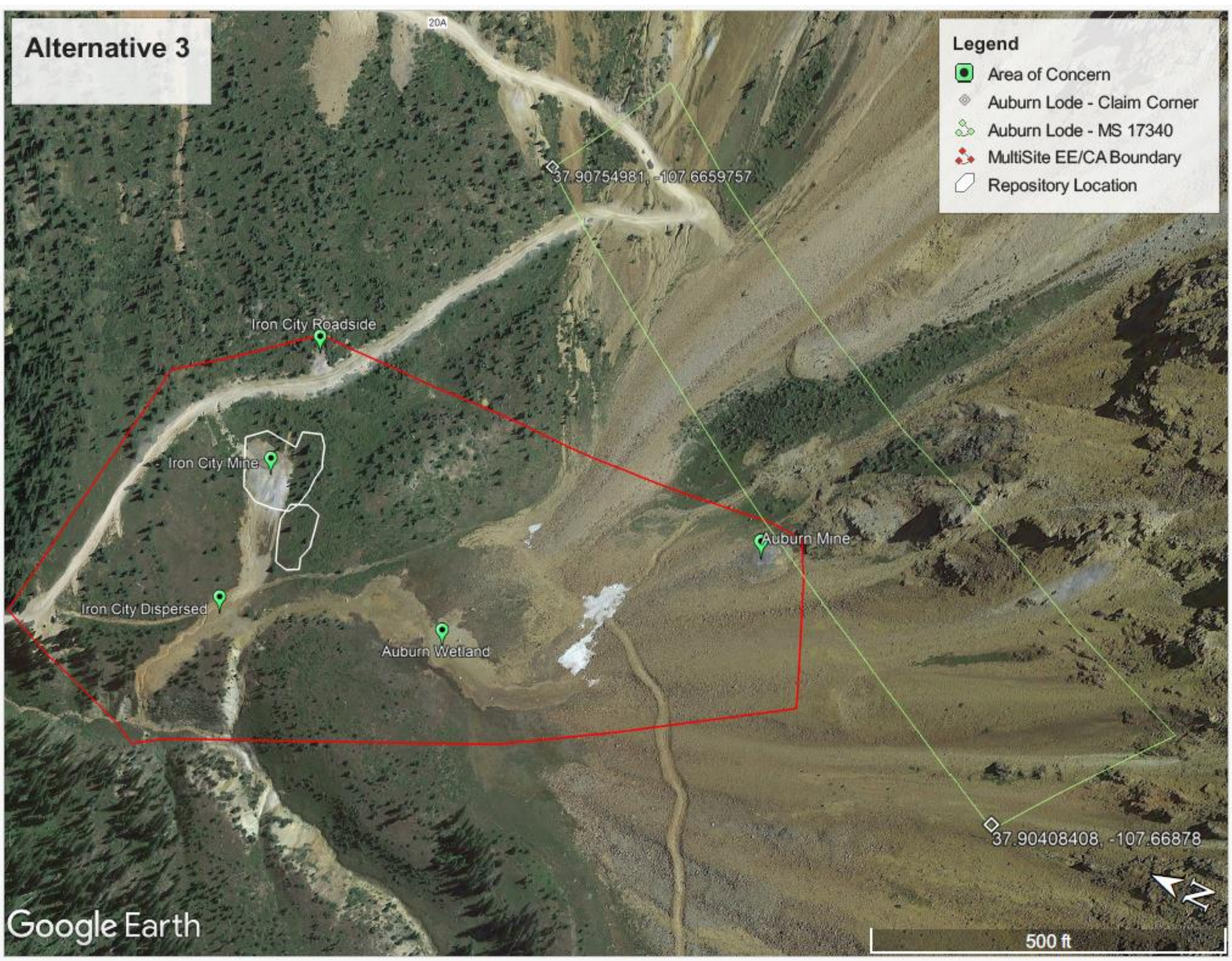

Figure 14: Alternative 3 Repository locations **(white polygons)**

The repository locations shown in Figure 14 are approximate locations and size and will need to be further defined in future design phases.

To implement this Alternative, TU proposes the use of a conveyance system to transport Auburn Waste Dump materials safely and efficiently downslope to the Auburn Wetland footprint where it can be staged for placement in the on-site repository. This conveyance method will require engineering and construction of an impermeable ditch or sluice box. Topography at and below the Auburn Mine lend themselves to conveying material as opposed to vehicle transport of the material at the Auburn. A conveyance channel may be the safest and most feasible way to remove materials from the Auburn Mine; road construction to this feature would require a road cut of roughly 40 feet. Moreover, the road would require one large switchback. Ripping and reclaiming this road post-reclamation does not align with the long-term goal for this site.

The distance required to transport material from the toe of the Auburn Mine to the staging area above the Auburn Wetland is 325 linear feet. Engineering of this reclamation structure to convey mine-impacted soils in a contained manner is the most feasible option developed by project partners.

This Alternative is considered the most effective on-site reclamation alternative because it will consolidate mine waste from each AOC, thereby reducing long-term weathering and mobilization concerns, and reducing on-site exposure to human and environmental receptors. However, the feasibility of constructing a conveyance channel and implementing this scope of removal is not easily definable.

7.1.4 Alternative 4: Off-Site Disposal, Surface Water Controls

Offsite disposal is a highly effective means of reducing human and environmental hazards at this Site, but implementability decreases due to the Site's remote location, risk of accidents from high road traffic volume, narrow sections of Corkscrew Pass Road, and ultimately, remediation cost.

TU has not been able to attain written confirmation from Montrose County Landfill, but according to materials provided online, contaminated soils may qualify. If not, a hazardous waste collection facility and landfill in Mesa County in Grand Junction, Colorado would be able to accommodate Site materials, albeit at a higher cost and transport distance. Given the disturbance and footprint to haul material from the Auburn Waste Dump; its volumetric addition is not included in this Alternative. The estimated material quantities for the remaining sites: Iron City Waste Dump – 3,669 cubic yards; and Iron City Dispersed – 565 cubic yards; the Auburn Waste Dump – 1310 cubic yards; and the Auburn Wetland – 218 cubic yards. Material quantities for Iron City Dispersed and Auburn Wetland assume the same excavation depths as stated in Alternative 1 and 2.

Overall, the cost to generate and haul the estimated 4,872 cubic yards to the Montrose County Landfill is prohibitive. An average cost was applied to this material quantity, and the total cost to recycle contaminated soils at the Montrose County Landfill was estimated to be $462,600.00. This cost does not include any other Removal Actions at the Site. Moreover, the Montrose County Landfill is 43 miles from the Site and would require 374 trips, assuming a 13 cubic yard load in a tandem axel dump truck. Hauling this quantity of material would account for an estimated 111 days.

The ability to implement this removal action alternative is considered low due to the long haul on narrow mountain roads with a high chance of accident/incident due to the high recreational traffic volume on the road, resulting in uncontrolled releases to unimpacted areas in Corkscrew Gulch. The number of truck-loads necessary to haul offsite would pose a significant risk to recreational users around the Site and within Corkscrew Gulch. Because of the site's high altitude and long winter season, interactions between hauling operations and recreational users would be unavoidable. Also, in association with the hauling, road maintenance would be necessary due to the repetitive moving of material on and off-site. Flagging crews

would also be needed during the entire construction window to ensure the safety of recreational visitors using the road. Due to the volume of trucking and high costs necessary to complete this Alternative, it is not ranked as the chosen alternative.

7.1.5 Alternative 5: No Action

As indicated above, 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. Under this alternative, no effort would be made to actively reduce risks to human health or the environment, or the migration of contaminated material off-site. A No Action Alternative would entail no changes to current site conditions.

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

Each alternative is evaluated against four criteria commonly derived from the Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA (USEPA, 1993). The evaluation criteria include whether the alternative achieved the removal action goal/factor, effectiveness, implementability, and cost. Within each primary criterion, EE/CA guidance recognizes several 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.

7.2.1 Achievement of Removal Action Goal

The recommended removal action alternative should meet or achieve the main goals of the overall project. The selected alternative should best attain whichever removal action factors are listed per section 300.415(b)(2).

7.2.2 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.

7.2.3 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.

7.2.4 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 Appendix B.

7.2.5 Long-term Effectiveness and Permanence

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

7.2.6 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.

7.2.7 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.

7.2.8 Implementability

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

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

7.2.10 Administrative Feasibility

The administrative feasibility criterion addresses the following factors:

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

7.2.11 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 **Appendix A** typically include the cost for construction activities, transportation, equipment, mobilization, and demobilization. The subtotaled capital cost of each alternative was multiplied by 20 percent for contingency to estimate total capital costs. Construction contingencies are important to provide flexibility to market values for materials, fuel, labor, and equipment. TU also associated a 10 percent contingency for project management and contracting costs. Given the complexity AOCs considered herein, oversight and implementation of the NTCRA may incur costs not included in the estimate.

7.3 Comparative Analysis of Each Alternative

The comparative analysis of the removal action alternatives is summarized in the table below. In addition, a quantitative ranking of the alternatives is presented. The comparative analysis and discussion of each of the criteria in relation to the removal action alternatives is presented in the following sections.

7.3.1 Effectiveness

Alternative 1—On-site Repository In-Place, Cap & Cover, In-situ Stabilization & Revegetation

Ranked on a scale of 1 to 5: High-Moderate (4)

- Covering of waste rock piles coupled with designated liners is an effective means of reducing physical and chemical hazards on-site, thereby reducing threats to human and environmental receptors.
- This alternative would provide long-term effectiveness if the repository and waste rock caps, surface water controls, and institutional controls are managed properly.
- The removal action steps proposed under this alternative can be implemented in a single field season and are technically feasible.

Alternative 2—On-site Repository Adjacent to Mine-Impacted Soils, Cap & Cover, In-situ Stabilization & Revegetation

Ranked on a scale of 1 to 5: Low-Moderate (2)

- Covering of waste rock piles coupled with designated liners is an effect means of reducing physical and chemical hazards on-site, thereby reducing threats to human and environmental receptors.
- This alternative would provide long-term effectiveness if the repository and waste rock caps, surface water controls, and institutional controls are managed properly.
- The removal action steps proposed under this alternative can be implemented in a single field season.
- Implementation of this alternative would create a larger disturbance footprint.

Alternative 3—On-site Repository In-Place of <u>All</u> Mine-Impacted Soils, Cap & Cover, In-situ Stabilization & Revegetation

Ranked on a scale of 1 to 5: Moderate (3)

- Covering of waste rock piles coupled with designated liners is an effective means of reducing physical and chemical hazards on-site, thereby reducing threats to human and environmental receptors
- This alternative would provide long-term effectiveness if the repository and waste rock caps, surface water controls, and institutional controls are managed properly.
- Consolidation of all mine-impacted soils on-site improves the long-term efficacy of this alternative, and in-turn, improves the reduction in threat to human and environmental receptors.
- The removal action steps proposed under this alternative can be implemented in a single field season.
- Implementation of this alternative would create a larger disturbance footprint, and the effectiveness of a conveyance mechanism is questionable.

Alternative 4—Off-site Disposal, Surface Water Controls, Revegetation

Ranked on a scale of 1 to 5: High (5)

- Removal of mine waste off-site would be a highly effective means of reducing threats to human and environmental receptors
  - Off-site disposal of material essentially shifts where this toxicity is found;
  - Landfills are generally located near communities and this alternative may have non-target effects to the off-site repository location and/or to surrounding communities.
- Surface water controls will reduce infiltration, decreasing the opportunity for metals precipitation. Moreover, surface water controls at the Iron City Mine site will reduce erosion and continued sedimentation of receiving perennial surface waters.
- Mine wastes found on-site could be removed in one to two field seasons according to this alternative.

Alternative 5—No Action

Ranked on a scale of 1 to 5: Low (1)

- This alternative is the least effective means of protecting human and environmental health, as the chemical and physical hazards would remain unchanged.

7.3.2 Implementability

Alternative 1—On-site Repository In-Place, Cap & Cover, In-situ Stabilization & Revegetation

Ranked on a scale of 1 to 5: High-Moderate (4)

- This alternative is very implementable given current best management practices (BMPs) and reclamation technologies.
- Consolidation of 4,875 CY of mine-impacted soils is feasible but will take significant time and resources to construct the on-site repository for long-term site health.
  - The repository location is within proximity to all AOCs and does not require significant heavy equipment along Corkscrew Pass Road
  - Most heavy equipment work will be confined to NFS Lands that will not impact seasonal recreational traffic in Corkscrew Gulch
- Surface water controls will reduce mobilization of material through surface water or groundwater pathways via infiltration.
- The rock cap of the Auburn waste materials does not eliminate weathering of this feature, but will reduce the mobility of this material
  - Diverting surface waters at the adit portal to reduce infiltration into the waste dump pile should reduce metal-loading
- Revegetation measures and in-situ soil amendments BMPs have proven highly effective

Alternative 2— Repository Adjacent to Mine-impacted Footprints, In-situ Amendments & Revegetation, Diversions

Ranked on a scale of 1 to 5: Moderate (3)

- This alternative is very implementable given current best management practices (BMPs) and reclamation technologies.
- Consolidation of 4,875 CY of mine-impacted soils is feasible but will take significant time and resources to construct the on-site repository for long-term site health.

  - The repository location is within proximity to all AOCs and does not require significant heavy equipment along Corkscrew Pass Road
  - Most heavy equipment work will be confined to NFS Lands that will not impact seasonal recreational traffic in Corkscrew Gulch
- By constructing the repository adjacent to mine-impacted soils:
  - Sufficient clean fill is generated
  - Areas of impact on-site grow by at least 0.5-acres in a relatively unproductive and harsh growing environment
  - Grows the acreage of NFS Lands that contain mine-impacted soils
- Surface water controls will reduce mobilization of material through surface water or groundwater pathways via infiltration.
- The rock cap of the Auburn waste materials does not eliminate weathering of this feature, but will reduce the mobility of this material.
  - Diverting surface waters at the adit portal to reduce infiltration into the waste dump pile should reduce metal-loading
- Revegetation measures and in-situ soil amendments BMPs have proven highly effective

Alternative 3 – On-Site Repository of ALL Mine-Impacted Soils, Cap and Cover, Surface Water Controls, Revegetation

Ranked on a scale of 1 to 5: Low-Moderate (2)

- This alternative is very implementable given current best management practices (BMPs) and reclamation technologies.
  - Conveyance structure to consolidate Auburn Mine can improve upon reclamation BMPs
- Consolidation of 5,765 CY of mine-impacted soils is feasible but will take significant time and resources to construct the on-site repository for long-term site health.
  - The repository location is within proximity to all AOCs and does not require significant heavy equipment along Corkscrew Pass Road
  - Most heavy equipment work will be confined to NFS Lands that will not impact seasonal recreational traffic in Corkscrew Gulch
- This alternative is considered the most effective on-site approach to eliminate short and long-term risks
  - This method does not increase the acreage of NFS Lands that contain mine wastes
- Surface water controls will reduce mobilization of material through surface water or groundwater pathways via infiltration.
  - Diverting surface waters at the adit portal to reduce infiltration into the waste dump pile should reduce metal-loading
- Revegetation measures and in-situ soil amendments BMPs have proven highly effective.
- There is inherent risk associated with removal of the Auburn waste dump with regards to potential impounded water. If an uncontrolled release were to occur, downstream resources could be damaged. Therefore, the implementability of this Alternative is ranked lower due to the risks associated with removal of the waste pile.

Alternative 4—Off-site Disposal, Surface Water Controls, Revegetation

Ranked on a scale of 1 to 5: Low (1)

- Removal of material to an off-site location is effective but difficult to implement given the technical hauling required.

- This alternative is technically feasible based on current BMPs and modern construction equipment.
- Modern equipment (excavators, dozers, loaders, etc.) can feasibly access all areas of the site in their current state.
  - The Auburn Mine is that exception, but through conveyance, material can feasibly be removed from this feature and hauled off-site.
- Administrative feasibility is the limiting factor due to the volume of material to be removed from the AOCs, hauled to various staging areas, and hauled to the nearest landfill.
  - This alternative would require significant infrastructure improvements to Corkscrew Pass Road up to the AOCs.
  - This alternative would require at least one full seasonal closure of Corkscrew Pass Road to all recreational use.
  - Seasonal closure would require full time traffic mitigation.

Alternative 5—No Action

Ranked on a scale of 1 to 5: High (5)

- This alternative is easily implemented.

7.3.3 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 Appendix A and is summarized below. Cost is ranked on a scale of Low (5) to High (1) based on the cumulative sum.

Estimated Cost Summary		
Alternative	**Final Cost**	**Rank**
Alternative 1: On-site Repository, Cap & Cover, In-situ Stabilization & Revegetation, Diversions	$ 818,307.15	Low-Moderate Cost (4)
Alternative 2: Repository Adjacent to Mine-impact Footprint, Cap & Cover, In-situ Amendments & Revegetation, Diversions	$ 844,209.15	Moderate Cost (3)
Alternative 3: On-site Repository of All Mine-impacted Soils, Cap and Cover, Surface Water Controls, Revegetation	$ 970,061.15	High-Moderate Cost (2)
Alternative 4: Off-site Disposal, Surface Water Controls, Revegetation	$ 1,585,402.44	High Cost (1)
Alternative 5: No Action	$ 0.00	Lowest Cost (5)

7.3.4 Final Ranking of Alternatives

A detailed description of how each alternative ranks for each criterion is presented in the previous subsections. The final ranking of the Alternatives compared to all criteria is summarized below.

Comparative Analysis of Alternatives				
Remedial Action	**Effectiveness**	**Implementability**	**Cost**	**Total**
Alternative 1	4	4	4	**12**
Alternative 2	2	3	3	8
Alternative 3	3	2	2	8
Alternative 4	5	1	1	7
Alternative 5	1	5	5	11

Section 8 – Recommended Removal Action Alternative

Based on the elements of the alternatives described in Section 7.2 and the comparative analysis and quantitative ranking in Section 7.3, the recommended alternative is **Alternative 1**— On-site Repository, Cap & Cover, Surface Water Diversion, In-situ Stabilization and Revegetation.

The recommended alternative couples effective and implementable BMPs for the Auburn and Iron City Mine sites. Removal Actions under this alternative will require surface water controls to reroute the Auburn adit discharge, and to serve as run-on/run-off controls to reduce fouling of water that currently flows across the Auburn waste dump. Based on implementability and effectiveness, the Auburn Mine waste dump removal action steps are limited to what can be safely managed within the existing site footprint. Also, due to the scale of impacts at the Iron City Mine, the chosen alternative elects to reduce the reclamation footprint wherever possible to limit impacts to the high alpine habitat in the area.

To address persistent hazards at the Auburn Mine, the chosen alternative recommends cap and cover of the Auburn Mine waste rock pile with native rock adjacent to the mine feature. Construction of a primary surface water channel should be used in combination with a rock cap. Adjacent to the waste rock feature, a slight topographical depression exists where native material should be harvested and stockpiled for capping. The waste dump should then be blended into that depression and existing topography to reduce the slope of the feature, followed by capping with stockpiled native rock. Installation of the surface water channel should begin at the adit portal and continue downslope to beyond the reclaimed waste rock pile footprint to reduce infiltration, interaction, and metals precipitation with any capped waste rock. It is suggested that the surface water diversion be lined with an impermeable synthetic (HDPE, PVC, EPDM) or clay-based material to reduce infiltration. To augment comprehensive removal action steps at the Auburn Mine, landowner access will be required to permit removal action steps on private lands (Auburn Claim, MS Number 17340). If this landowner is unwilling to participate in the project, this portion of the removal action should be reconsidered for effectiveness. Downslope, the Auburn Wetland, impacted by chemical insults stemming from the Auburn Mine, should be reclaimed in-situ. This method will require import of soil amendments to stabilize soils, buffer soil pH, and improve organic material content of the wetland. The constructed wetland and associated plants will act as a buffer to downslope portions of the site by reducing the migration of contaminants.

The existing disturbed portion of the Iron City Mine will house all Iron City Mine wastes into an on-site repository made up of two consolidation cells. Iron City Mine wastes included in this feature are considered all materials that cannot be amended in-situ. This repository should include space for estimated material quantities from the Iron City Waste Dump – 3,669 cubic yards, Iron City Roadside – 890 cubic yards, and

Iron City Dispersed – 565 cubic yards. The repository should retain space for two consolidation cells: a fully enclosed repository cell to house material from the Roadside feature, and a larger cell housing Iron City Waste Dump and Iron City Dispersed materials. This decision is based on metals concentrations, AGP, and risk to ecological receptor groups of this material. The larger repository cell should incorporate an impermeable liner on top of consolidated waste to reduce infiltration rates into the repository. That liner shall be comprised of an engineered product or GCL. Reclamation of the Iron City Mine will include run-on/runoff surface water controls to reduce flow across the feature. This will be coupled with extensive roadwork and engineering along Corkscrew Gulch Road to eliminate gullies and rilling. Surface water diversion controls or channels shall be constructed in combination with road drainage features to efficiently shed water away from the constructed repository on the up and downslope sides of the feature. These channels should extend downslope from the road until a point past the constructed repository where flow is dispersed in a drainage fan or dissipation basin. Road work should also include engineering of rock buttresses or similar retaining wall features at the base of the excavated footprint of the Iron City Roadside feature. Lastly, the top layer of soil from the depositional zone below the Iron City waste dump should be consolidated into the repository, followed by in-situ reclamation of the remaining material, and blended into the adjacent topography. In-situ reclamation will have the intent of native vegetative establishment up to the constructed diversion channels to help tie all site features together.

Overall, reclamation actions are informed based on analytical data provided by state-accredited laboratories. Data provided by pre-selected lab is then compared to State and Federal regulatory standards and screening levels. Those exceedances are as follows: Roadside arsenic concentrations have a BLM Recreational EF of 159 and an EPA Industrial EF of 1,627. Lead concentrations at the Roadside have a BLM Recreational EF of 5 and an EPA Residential EF of 10. Arsenic concentrations from Auburn Mine soils exceeded BLM and EPA screening levels by 14 and 150 times, respectively. Surface water collected from the Auburn adit discharge exceeded human health SLs for Aluminum, Antimony, Arsenic, Cadmium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Thallium, and Vanadium. Soils collected from the Auburn Wetland feature contain Arsenic and Iron that exceed all EPA and BLM SLs, by a factor as high as 133 for EPA's Residential SL. Arsenic and Lead concentrations found at the Iron City Mine exceed all EPA and BLM SLs, and the EPA Residential SL for Iron and Copper. Acid Base Accounting (ABA, % sulfates) collected from the Roadside pile indicates the Acid-Generating Potential (AGP) for this AOC is 175 with a soil pH of 3.9, suggesting that it has an extremely high probability of leaching metals.

Ecological Screening Values (ESV) evaluated to determine impacts to primary biological receptors groups identified risk at all legacy mining feature of the Site. Recall that terrestrial ESVs account for plants, invertebrates, birds, and mammal receptor groups. Measured metals concentrations at the Iron City Waste Dump: Arsenic exceeds all receptor groups, Chromium exceeds invertebrate receptor groups, Copper exceeds all receptor groups, Lead exceeds plant and bird and mammal receptor groups, Zinc exceeds all receptor groups. Measured metals concentrations at the Iron City Roadside: Arsenic exceeds all receptor groups, Copper exceeds all receptor groups, Lead exceeds all receptor groups, Silver exceeds bird and mammal receptor groups, Zinc exceeds bird and mammal receptor groups. Measured metals concentrations at the Iron City Dispersed: Arsenic exceed all receptor groups, Chromium exceeds invertebrate receptor groups, Copper exceeds bird and plant and mammal receptor groups, Lead exceeds plant and bird and mammal receptor groups, Silver exceeds bird and mammal receptor groups, Zinc exceeds all receptor groups. Measured metals concentrations at the Auburn Wetland: Arsenic exceeds all receptor groups, Chromium exceeds invertebrate receptor groups, Lead exceeds plant and bird and mammal receptor groups, Selenium exceeds plant and bird and mammal receptors, and Silver exceeds bird receptor values.

By following the steps outlined in Section 7 and 8 of this EE/CA, implementation of removal action Alternative 1 - On-site Repository, Cap & Cover, Surface Water Diversion, In-situ Stabilization and Revegetation, will be most protective of human health and the environmental factors present at the site.

Section 9 – Literature Cited

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Tables

Table 5.1: Composite Auburn Waste Rock Soil Results for Analytes that Exceed 3x Background Soil in Comparison to Human Health Screening Levels (ABR-MP01-01)

Analyte	Result (mg/kg)	Flag	BKG Soil Result (mg/kg)	BKG EF	Recreation SL (mg/kg)[1]	Recreation SL EF	Industrial SL (mg/kg)[2]	Industrial SL EF
Antimony	60.8	D	3.1	20	782	<0.1	470	0.13
Arsenic	300	D	57.9	5.2	30.6	9.8	3	100
Cadmium	2.22	D	0.0688	32	1780	<0.1	980	<0.1
Copper	393	D	23.2	17	78200	<0.1	47000	<0.1
Lead	520	BD	81.8	6.4	800	0.65	800	0.65
Mercury	1.35	D	0.05	27	271	<0.1	46	<0.1
Potassium	11800	D	1260	9.4	NE	NA	NE	NA
Selenium	12.6	JD	2.33	5.4	9780	<0.1	5800	<0.1
Silver	39.9	D	0.429	93	9780	<0.1	5800	<0.1
Thallium	2.56	D	0.485	5.3	19.6	0.13	12	0.21
Zinc	551	D	22.8	24	587000	<0.1	350000	<0.1

[1] Cox, 2017. BLM Technical Memorandum: Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites. United States Bureau of Land Management. September.
[2] USEPA 2020. Regional Screening Levels (RSLs) – Generic Tables. Last updated May 2020. Values in **red** represent Background EF > 3 or SL EF > 1
B = The analyte was detected in the sample as well as in the associated blank BKG = Background
D = Sample diluted prior to analysis; reported result is for undiluted sample EF = Exceedance Factor
J = Laboratory quality control review indicates that this result is considered estimated mg/kg = milligrams per kilogram NA = Not applicable NE = Not established SL = Screening Level

Table 5.2: Auburn Composite Waste Rock Soil Results for Analytes that Exceed 3x Background Soil in Comparison to Ecological Screening Level (ABR-SO-MP01-01)

Analyte	Result (mg/kg)	Flag	Background Soil Result (mg/kg)	BKG EF	P&I SL[1] (mg/kg)	P&I EF	B&M SL[1] (mg/kg)	B&M EF
Antimony	60.8	D	3.1	20	78	0.78	0.27	230
Arsenic	300	D	57.9	5.2	18	17	43	7
Cadmium	2.22	D	0.0688	32	140	<0.1	0.36	6.2
Copper	393	D	23.2	17	70	5.6	28	14
Lead	520	BD	81.8	6.4	120	4.3	11	47
Mercury	1.35	D	0.05	27	NE	NA	NE	NA
Potassium	11800	D	1260	9.4	NE	NA	NE	NA
Selenium	12.6	JD	2.33	5.4	0.52	24	0.63	20
Silver	39.9	D	0.429	93	560	<0.1	14	2.8
Thallium	2.56	D	0.485	5.3	NE	NA	NE	NA
Zinc	551	D	22.8	24	120	4.6	46	12

[1] USEPA Maximum Contaminant Level (MCL), National Primary Drinking Water Regulations Values in **red** represent SL EF > 1
*Result was undetectable, but detection limit was below applicable SL
D = Sample diluted prior to analysis; reported result is for undiluted sample EF = Exceedance factor
MCL - Maximum contaminant level ug/L - micrograms per liter
SL = Screening level
U = Laboratory analysis indicates that the analyte was undetected at the concentration shown

Table 5.3: Auburn Waste Rock SPLP Results for Analytes that Exceed 3x Background Soil in Comparison to MCLs with 20x Dilution Attenuation Factor (ABR-SO-MP01-01)

Analyte	Result (ug/L)	Flag	20x MCL[1] (ug/L)	20x MCL EF
Antimony	10.3	J	120	<0.1
Arsenic	24		200	0.12
Cadmium	0.97	J	100	<0.1
Copper	1430		26000	<0.1
Lead	52.5		300	0.18
Silver*	10	U	NE	NA
Zinc	624		NE	NA

[1] USEPA Maximum Contaminant Level (MCL), National Primary Drinking Water Regulations Values in **red** represent SL EF > 1
*Result was undetectable, but detection limit was below applicable SL
D = Sample diluted prior to analysis; reported result is for undiluted sample EF = Exceedance factor
MCL - Maximum contaminant level ug/L - micrograms per liter
SL = Screening level
U = Laboratory analysis indicates that the analyte was undetected at the concentration shown

Table 5.4: Auburn Adit Water Results Exceeding Human Health SLs (ABR-SW-A01-01)

Analyte	Result (ug/L)	Flag	MCL[1] (ug/L)	MCL EF
Antimony, Total*	25	U	6	4.2
Arsenic, Total	1460	D	10	150
Beryllium, Total*	20	U	4	5
Cadmium, Total	47.6	D	5	9.5
Chromium, Total	388	D	100	3.9
Copper, Total	67000	JD	1300	52
Lead, Total	113	D	15	7.5
Thallium, Total*	50	U	2	25

Table 5.5: Auburn Adit Water Results Exceeding to Human Health SLs (ABR-SW-A02-01)

Analyte	Result (ug/L)	Flag	MCL[1] (ug/L)	MCL EF
Antimony, Total*	25	U	6	4.2
Arsenic, Total	1490	D	10	150
Beryllium, Total*	20	U	4	5
Cadmium, Total	47.6	D	5	9.5
Chromium, Total	396	D	100	4
Copper, Total	69100	D	1300	53
Lead, Total	102	D	15	6.8
Thallium, Total*	50	U	2	25

[1] USEPA Maximum Contaminant Level (MCL), National Primary Drinking Water Regulations Values in **red** represent SL EF > 1
*Result was undetectable, but detection limit was below applicable SL
D = Sample diluted prior to analysis; reported result is for undiluted sample EF = Exceedance factor
MCL - Maximum contaminant level ug/L - micrograms per liter
SL = Screening level
U = Laboratory analysis indicates that the analyte was undetected at the concentration shown

Table 5.6: Auburn Adit Water Results Exceeding Ecological SLs (ABR-SW-A01-01).

Analyte	Result (ug/L)	Flag	Site-specific Chronic SL [1]	SS Chronic EF	Site-specific Acute ESV[1]	SS Acute EF
Aluminum, Total	1050000	DE	87	12000	2000	520
Arsenic, Dissolved	1440	D	150	9.6	340	4.2
Cadmium, Dissolved	47	D	0.32	150	1.2	39
Chromium, Dissolved	395	D	54	7.3	21000	<0.1
Copper, Dissolved	70400	D	6.4	11000	9.3	7500
Lead, Dissolved	112	D	1.6	68	42	2.6
Manganese, Dissolved	3180	D	1500	2.2	2600	1.2
Nickel, Dissolved	1970	D	38	52	340	5.8
Selenium, Dissolved	50	U	4.6	11	18	2.7
Silver, Dissolved*	25	U	0.039	650	1	24
Zinc, Dissolved	10200	D	52	200	110	91
Hardness as $CaCO_3$	68,000		NE	NA	NE	NA

[1] Hardness-based value in accordance with Colorado Department of Public Health and Environment Water Quality Control Commission, 2018. Regulation No. 31
Values in **red** represent SL EF > 1
*Result was undetectable, but detection limit was below applicable SL
D = Sample diluted prior to analysis; reported result is for undiluted sample EF = Exceedance factor
J = Laboratory quality control review indicates that this result is considered estimated ug/L - micrograms per liter
NA = Not applicable/Not analyzed NE = Not established
SL = Screening level
U = Laboratory analysis indicates that the analyte was undetected at the concentration show

Table 5.7: Adit Water Results Exceeding Ecological SLs (ABR-SW-A01-02).

Analyte	Result (ug/L)	Flag	Site-specific Chronic SL [1]	SS Chronic EF	Site-specific Acute ESV[1]	SS Acute EF
Aluminum, Total	1050000	DE	87	**12000**	2100	**510**
Arsenic, Dissolved	1440	D	150	**9.6**	340	**4.2**
Cadmium, Dissolved	42.5	D	0.32	**130**	1.2	**34**
Chromium, Dissolved	388	D	55	**7.1**	21000	<0.1
Copper, Dissolved	69700	D	6.5	**11000**	9.5	**7400**
Iron, Total	2790000	DE	1000	**2800**	NE	NA
Lead, Dissolved	85	D	1.7	**51**	43	**2**
Manganese, Dissolved	3180	D	1500	**2.2**	2600	**1.2**
Nickel, Dissolved	1940	D	38	**51**	340	**5.7**
Selenium, Dissolved*	50	U	4.6	**11**	18	**2.7**
Silver, Dissolved*	25	U	0.04	**630**	1.1	**23**
Zinc, Dissolved	9700	D	53	**180**	110	**85**
Hardness as $CaCO_3$	69,000		NE	NA	NE	NA

[1] Hardness-based value in accordance with Colorado Department of Public Health and Environment Water Quality Control Commission, 2018. Regulation No. 31
Values in **red** represent SL EF > 1
*Result was undetectable, but detection limit was below applicable SL
D* = Sample diluted prior to analysis; reported result is for undiluted sample EF = Exceedance factor
T = Total Metals
J = Laboratory quality control review indicates that this result is considered estimated ug/L - micrograms per liter
NA = Not applicable/Not analyzed SL = Screening level
U = Laboratory analysis indicates that the analyte was undetected at the concentration

Table 5.8: Summary of the total metal concentrations in Auburn Wetland composite soil samples compared to regulatory SLs to identify site-specific COPCs. Red values indicate SL exceedance.

Chemical	BLM Recreational SL (mg/kg)	EPA Residential SL (mg/kg)	EPA Industrial SL (mg/kg)	Results (mg/kg)	SL Exceedances	COPCs
Aluminum	>1,000,000	77,000	>1,000,000	9,190.00	no	--
Antimony	782	31	470	NA	no	--
Arsenic	**30.6**	**0.68**	**3**	**90.6**	**yes**	**All**
Barium	390,000	15,000	220,000	NA	no	--
Beryllium	3,910	160	2,300	NA	no	--
Cadmium	1,780	71	980	BDL	no	--
Chromium	>1,000,000	120,000	>1,000,000	15.50	no	--
Cobalt	586	23	350	NA	no	--
Copper	78,200	3,100	47,000	177.00	no	--
Iron	**>1,000,000**	**55,000**	**820,000**	**147,000.00**	**yes**	**Residential**
Lead	800[a]	400	800	219	no	--
Manganese	46,700	1,800	26,000	37.90	no	--
Mercury	271	11	46	NA	no	--
Molybdenum	9,780	390	5,800	NA	no	--
Nickel	39,000	1,500	22,000	1.11	no	--
Selenium	9,780	390	5,800	6.01	no	--
Silver	9,780	390	5,800	9.50	no	--
Thallium	19.6	0.78	12	NA	no	--
Uranium	391	16	230	NA	no	--
Vanadium	9,850	390	5,800	NA	no	--
Zinc	587,000	23,000	350,000	16.2	no	--
Primary Exposure Assumptions	14 days/year, 26 years, adult/child	350 days/year, 26 years, adult/child	225 days/year, 25 years, adult			

Table 5.9: Auburn Wetland Soil Sample Results Compared to Regulatory Screening Levels (SLs). *Only Presents SL Exceedances. Red values indicate exceedance.

Exceedance Summary Table							
Analyte	Auburn Wetland Result (mg/kg)	BLM Recreational SL (mg/kg)	Recreational EF	EPA Residential SL	Residential EF	EPA Industrial SL	Industrial EF
Arsenic	90.60	30.6	3	0.68	133	3	30
Iron	147,000	1,000,000	0	55,000	3	820,000	0

Table 5.10: Auburn Wetland Soil Sample Results Compared to Regulatory ESVs for Plants, Invertebrates, Birds, and Mammals. *Only Presents ESV Exceedances. Red values indicate exceedance.

Soil Ecological Screening Values (mg/kg)								
Analyte	**Plants SL (mg/kg)**	**Plants EF**	**Invertebrates SL (mg/kg)**	**Invertebrates EF**	**Birds SL (mg/kg)**	**Birds EF**	**Mammals SL (mg/kg)**	**Mammals EF**
Arsenic	18	5	6.8	13	43	2	46	2
Chromium	--	-	0.4	39	26	1	34	-
Copper	70	3	80	2	28	6	49	4
Lead	120	2	1700	-	11	20	56	4
Selenium	0.52	12	4.1	1	1.2	5	0.63	10
Silver	560	-	--	-	4.2	2	14	1

Table 5.11: Hazard Quotient Summary Table

Auburn Wetland Maximum HQs						**COPEC**	
Analyte	**Max Detected (mg/kg)**	**Plants**	**Invertebrates**	**Birds**	**Mammals**	**HQ sum**	**% total Risk**
Aluminum	9,190	NA	NA	NA	NA		NA
Arsenic	**90.6**	**5.0**	**13.3**	**2.1**	**2.0**	**22.4**	**20.7%**
Cadmium	0	0.0	0.0	0.5	1.0	1.5	1.4%
Chromium	**15.5**	**NA**	**38.8**	**0.6**	**0.5**	**39.8**	**36.8%**
Copper	**177**	**2.5**	**2.2**	**6.3**	**3.6**	**14.7**	**13.6%**
Iron	147,000	NA	NA	NA	NA		NA
Lead	**219**	**1.8**	**0.1**	**19.9**	**3.9**	**25.8**	**23.8%**
Manganese	37.9	0.2	0.1	0.0	0.0	0.3	0.3%
Nickel	1.11	0.0	0.0	0.0	0.0	0.0	0.0%
Selenium	6.01	NA	NA	NA	NA		NA
Silver	9.5	0.0	NA	2.3	0.7	3.0	2.7%
Zinc	16.2	0.1	0.1	0.4	0.2	0.8	0.7%

Table 5.12: Summary of the total metal concentrations in Iron City composite soil samples compared to regulatory SLs to identify site-specific COPCs. *Waste Dump concentrations (mg/kg) and 1999 SI Results (mg/kg) comparing successive long-term events at the same composite soil sample locations. Red values indicate SL exceedance.

Chemical	BLM Recreational SL (mg/kg)	EPA Residential SL (mg/kg)	EPA Industrial SL (mg/kg)	*Waste Dump (mg/kg)	*1999 SI Results (mg/kg)	Roadside (mg/kg)	Dispersed (mg/kg)	SL Exceeded
Aluminum	>1,000,000	77,000	>1,000,000	17,800	1,710	4,430	15,900	--
Antimony	782	31	470	ND	26.5	ND	ND	--
Arsenic	30.6	0.68	3	1,480	489	4,880	320	All SLs/All Sites
Barium	390,000	15,000	220,000	ND	337	ND	ND	--
Beryllium	3,910	160	2,300	ND	ND	ND	ND	--
Cadmium	1,780	71	980	ND	1.10	1	ND	--
Chromium	>1,000,000	120,000	>1,000,000	3	0.81	ND	4.71	--
Cobalt	586	23	350	ND	0.57	ND	ND	--
Copper	78,200	3,100	47,000	3,280	1,260	6,060	113	Residential - Waste Dump & Roadside
Iron	>1,000,000	55,000	820,000	19,300	22,700	55,300	44,900	Residential - Roadside
Lead	800[a]	400	800	1,360	729	4,120	234	All SLs - Waste Dump & Roadside
Manganese	46,700	1,800	26,000	244	3.20	7.06	203	--
Mercury (elemental)	271	11	46	ND	0.52	ND	ND	--
Molybdenum	9,780	390	5,800	ND		ND	ND	--
Nickel	39,000	1,500	22,000	1.26	0.22	0.97	1.24	--
Selenium	9,780	390	5,800	5.6	2.2	18.2	ND	--
Silver	9,780	390	5,800	28.1	3.4	81.9	ND	--
Thallium	19.6	0.78	12	ND	3	ND	ND	--
Uranium	391	16	230	ND		ND	ND	--
Vanadium	9,850	390	5,800	ND	3	ND	ND	--
Zinc	587,000	23,000	350,000	292	164	129	33	--
Primary Exposure Assumptions	14 days/year, 26 years, adult/child	350 days/year, 26 years, adult/child	225 days/year, 25 years, adult					

Table 5.13: Iron City Waste Dump 2021 Soil Sample Results Compared to Regulatory Screening Levels (SLs). *Only Presents SL Exceedances. Red values indicate SL exceedance.

Analyte	Waste Dump Results (mg/kg)	BLM Recreational SL (mg/kg)	Recreational EF	EPA Residential SL (mg/kg)	Residential EF	EPA Industrial SL (mg/kg)	Industrial EF
Arsenic	1,480	30.6	48	0.68	2176	3	493
Copper	3,280	78,200	0	3,100	1	47,000	0.13
Lead	1,360	800	2	400	3	800	2

Table 5.14: Iron City Waste Dump Soil Sample Results Compared to Regulatory SLs. This table presents data provided in the 2000 CDPHE Site Inspection. *Only Presents SL Exceedances. Red values indicate SL exceedance.

Analyte	1999 Waste Dump SI (mg/kg)	BLM Recreational SL (mg/kg)	Recreational EF	EPA Residential SL (mg/kg)	Residential EF	EPA Industrial SL (mg/kg)	Industrial EF
Arsenic	489	30.6	16	0.68	719	3	163
Lead	729	800	0	400	2	800	1

Table 5.15: Iron City Roadside Soil Sample Results Compared to Regulatory SLs for both BLM and EPA categories*Only Presents Screening Level Exceedances. Red values indicate SL exceedance.

Analyte	Roadside Results (mg/kg)	BLM Recreational SL (mg/kg)	Recreational EF	EPA Residential SL (mg/kg)	Residential EF	EPA Industrial SL (mg/kg)	Industrial EF
Arsenic	4,880	30.6	159	0.68	7176	3	1627
Copper	6,060	78,200	0	3,100	2	47,000	0.13
Iron	55,300	1,000,000	0	55,000	1.01	820,000	0
Lead	4,120	800	5	400	10	800	5

Table 5.16: Iron City Dispersed Soil Sample Results Compared to Regulatory SLs. *Only Presents SL Exceedances. Red values indicate SL exceedance.

Analyte	Dispersed Results (mg/kg)	BLM Recreational SL (mg/kg)	Recreational EF	EPA Residential SL (mg/kg)	Residential EF	EPA Industrial SL (mg/kg)	Industrial EF
Arsenic	320	30.6	10	0.68	471	3	107

Table 5.17: Iron City Waste Dump ESVs Summary Table. Red values indicate exceedance factor.

Analyte	Plants (mg/kg)	Plants EF	Invertebrates (mg/kg)	Invertebrates EF	Birds (mg/kg)	Birds EF	Mammals (mg/kg)	Mammals EF
Aluminum	--	-	--		--		--	
Arsenic	18	82	6.8	218	43	34	46	32
Cadmium	32	-	140	-	0.77	-	0.36	-
Chromium	--	-	0.4	8	26	0	34	0
Copper	70	47	80	41	28	117	49	67
Iron	--	-		-	--	-	--	-
Lead	120	11	1700	1	11	124	56	24
Manganese	220	1	450	1	4300	0	4000	0
Nickel	38	0	280	0	210	0	130	0
Selenium	0.52	-	4.1	-	1.2	-	0.63	-
Silver	560	0	--	-	4.2	7	14	2
Zinc	160	2	120	2	46	6	79	4

Table 5.18: Iron City Waste Dump – Maximum Hazard Quotient (HQ) Values

Analyte	Max Detected (mg/kg)	Plants	Invertebrates	Birds	Mammals	HQ sum	% Total Risk
Aluminum	17800	NA	NA	NA	NA	0.0	0%
Arsenic	**1480**	**82.2**	**217.6**	**34.4**	**32.2**	**366.5**	**44%**
Cadmium	0	0.0	0.0	0.0	0.0	0.0	0%
Chromium	3	NA	7.5	0.1	0.1	7.7	0.9%
Copper	**3280**	**46.9**	**41.0**	**117.1**	**66.9**	**271.9**	**33%**
Iron	19300	NA	NA	NA	NA	0.0	0%
Lead	**1360**	**11.3**	**0.8**	**123.6**	**24.3**	**160.1**	**19%**
Manganese	244	1.1	0.5	0.1	0.1	1.8	0%
Nickel	1.26	0.0	0.0	0.0	0.0	0.1	0%
Selenium	5.62	NA	NA	NA	NA	0.0	0%
Silver	28.1	0.1	NA	6.7	2.0	8.7	1%
Zinc	292	1.8	2.4	6.3	3.7	14.3	2%
					Total Risk	831.0	100%

Table 5.19: Iron City Roadside ESVs Summary Table. Red values indicate SL exceedance.

Analyte	Plants (mg/kg)	Plants EF	Invertebrates (mg/kg)	Invertebrates EF	Birds (mg/kg)	Birds EF	Mammals (mg/kg)	Mammals EF
Aluminum	--	-	--	-	--	-	--	-
Arsenic	18	271	6.8	718	43	113	46	106
Cadmium	32	-	140	-	0.77	-	0.36	-
Chromium	--	-	0.4	-	26	-	34	-
Copper	70	87	80	76	28	216	49	124
Iron	--	-		-	--	-	--	-
Lead	120	34	1700	2	11	375	56	74
Manganese	220	0	450	0	4300	0	4000	0
Nickel	38	0	280	0	210	0	130	0
Selenium	0.52	-	4.1	-	1.2	-	0.63	-
Silver	560	0	--	-	4.2	20	14	6
Zinc	160	1	120	1	46	3	79	2

Table 5.20: Iron City Roadside – Maximum Hazard Quotient (HQ) Values

Analyte	Max Detected (mg/kg)	Plants	Invertebrates	Birds	Mammals	HQ sum	% Total Risk
Aluminum	4430	NA	NA	NA	NA	0.0	0%
Arsenic	**4880**	**271.1**	**217.6**	**34.4**	**32.2**	**555.4**	**52%**
Cadmium	1.17	0.00	0.0	0.0	0.0	0.0	0%
Chromium	0	NA	7.5	0.1	0.1	0.0	0%
Copper	**6060**	**86.6**	**41.0**	**117.1**	**66.9**	**311.7**	**29%**
Iron	55300	NA	NA	NA	NA	0.0	0%
Lead	**4120**	**34.3**	**0.8**	**123.6**	**24.3**	**183.1**	**17%**
Manganese	7.06	0.0	0.5	0.1	0.1	0.7	0.06%
Nickel	0.97	0.0	0.0	0.0	0.0	0.0	0%
Selenium	18.2	35.0	NA	NA	NA	0.0	0%
Silver	81.9	0.1	NA	6.7	2.0	8.8	1%
Zinc	129	0.8	2.4	6.3	3.7	13.3	1%
					Total Risk	1072.9	100%

Table 5.21: Iron City Dispersed ESVs Summary Table. Red values indicate SL exceedance.

Analyte	Plants (mg/kg)	Plants EF	Invertebrates (mg/kg)	Invertebrates EF	Birds (mg/kg)	Birds EF	Mammal s (mg/kg)	Mammals EF
Aluminum	--	-	--	-	--	-	--	-
Arsenic	18	18	6.8	47	43	7	46	7
Cadmium	32	-	140	-	0.77	-	0.36	-
Chromium	--	-	0.4	12	26	0	34	0
Copper	70	2	80	1	28	4	49	2
Iron	--	-		-	--	-	--	-
Lead	120	2	1700	0	11	21	56	4
Manganese	220	1	450	0	4300	0	4000	0
Nickel	38	0	280	0	210	0	130	0
Selenium	0.52	-	4.1	-	1.2	-	0.63	-
Silver	560	0	--	-	4.2	7	14	2
Zinc	160	2	120	2	46	6	79	4

Table 5.22: Iron City Dispersed – Maximum Hazard Quotient (HQ) Values

Analyte	Max Detected (mg/kg)	Plants	Invertebrates	Birds	Mammals	HQ sum	% total Risk
Aluminum	15900	NA	NA	NA	NA	0.0	0%
Arsenic	**320**	**82.2**	**217.6**	**34.4**	**32.2**	**366.5**	**52%**
Cadmium	0	0.0	0.0	0.0	0.0	0.0	0%
Chromium	4.71	NA	7.5	0.1	0.1	0.2	0%
Copper	**116**	**46.9**	**41.0**	**117.1**	**66.9**	**154.8**	**22%**
Iron	44900	NA	NA	NA	NA	0.0	0%
Lead	**234**	**11.3**	**0.8**	**123.6**	**24.3**	**160.1**	**23%**
Manganese	203	1.1	0.5	0.1	0.1	1.8	0%
Nickel	1.24	0.0	0.0	0.0	0.0	0.1	0%

Table 5.23: Summarizes RCRA METALS Maximum SPLP Leachate for ALL Iron City Soils; Maximum load was identified for each AOC

Iron City - Loading Chart - Pounds / Day								
Analyte	**Al**	**As**	**Cr**	**Cu**	**Fe**	**Pb**	**Mn**	**Zn**
100-year event	0.569	0.167	0	2.537	9.455	6.239	0.029	0.202
500-year event	0.825	0.243	0	3.678	13.710	9.046	0.042	0.293
MAX SPLP - Site	Roadside	Roadside	Non-Detect	Waste Dump	Roadside	Roadside	Roadside	Waste Dump

Table 5.24: Summarizes RCRA METALS Maximum SPLP Leachate for Auburn Wetland soils

Auburn Wetland - Loading Chart - Pounds / Day								
Analyte	**Al**	**As**	**Cr**	**Cu**	**Fe**	**Pb**	**Mn**	**Zn**
100-year event	0.140752	0	0	0.044903	0.10880232	4.991091	0	0
500-year event	0.202331	0	0	0.064547	0.15640334	7.174693	0.033515	0.23212241

Table 5.25: ABA results for the Auburn Wetland AOC indicate:

Acid Generation Potential	38.4	t CaCO3/Kt
Acid Neutralization Potential	0	t CaCO3/Kt
Acid-Base Potential	-38.4	t CaCO3/Kt
Neutralization Potential	<0.1	% CaCO3
pH, Saturated Paste	3.3	units
Solids, Percent	85.0	%
Sulfur Organic Residual	0..98	%
Sulfur Pyritic Sulfide	0.01	%
Sulfur Sulfate	0.27	%
Sulfur Total	1.23	%

Table 5.26: ABA results for the Iron City Waste Dump AOC indicate:

Acid Generation Potential	40.6	t CaCO3/Kt
Acid Neutralization Potential	0	t CaCO3/Kt
Acid-Base Potential	-40.6	t CaCO3/Kt
Neutralization Potential	<0.1	% CaCO3
pH, Saturated Paste	3.9	units
Solids, Percent	87.6	%
Sulfur Organic Residual	0.58	%
Sulfur Pyritic Sulfide	0.43	%
Sulfur Sulfate	0.29	%
Sulfur Total	1.30	%

Table 5.27: ABA for the Iron City Roadside AOC indicate:

Acid Generation Potential	175	t CaCO3/Kt
Acid Neutralization Potential	0	t CaCO3/Kt
Acid-Base Potential	-175	t CaCO3/Kt
Neutralization Potential	<0.1	% CaCO3
pH, Saturated Paste	3.9	units
Solids, Percent	87.8	%
Sulfur Organic Residual	1.87	%
Sulfur Pyritic Sulfide	3.54	%
Sulfur Sulfate	0.18	%
Sulfur Total	5.59	%
Total Sulfur minus Sulfate	5.41	%

Table 5.28: ABA for the Iron City Dispersed AOC indicates:

Acid Generation Potential	10.3	t CaCO3/Kt
Acid Neutralization Potential	0	t CaCO3/Kt
Acid-Base Potential	-10.3	t CaCO3/Kt
Neutralization Potential	<0.1	% CaCO3
pH, Saturated Paste	4.2	units
Solids, Percent	85.1	%
Sulfur Organic Residual	0.17	%
Sulfur Pyritic Sulfide	0.02	%
Sulfur Sulfate	0.14	%

Sulfur Total	0.33	%

Figures

Figure 1: Corkscrew Gulch, Uncompahgre National Forest. This figure presents relevant claim boundaries and claim tract numbers. *Map projections may be altered due to terrain or georeferencing.

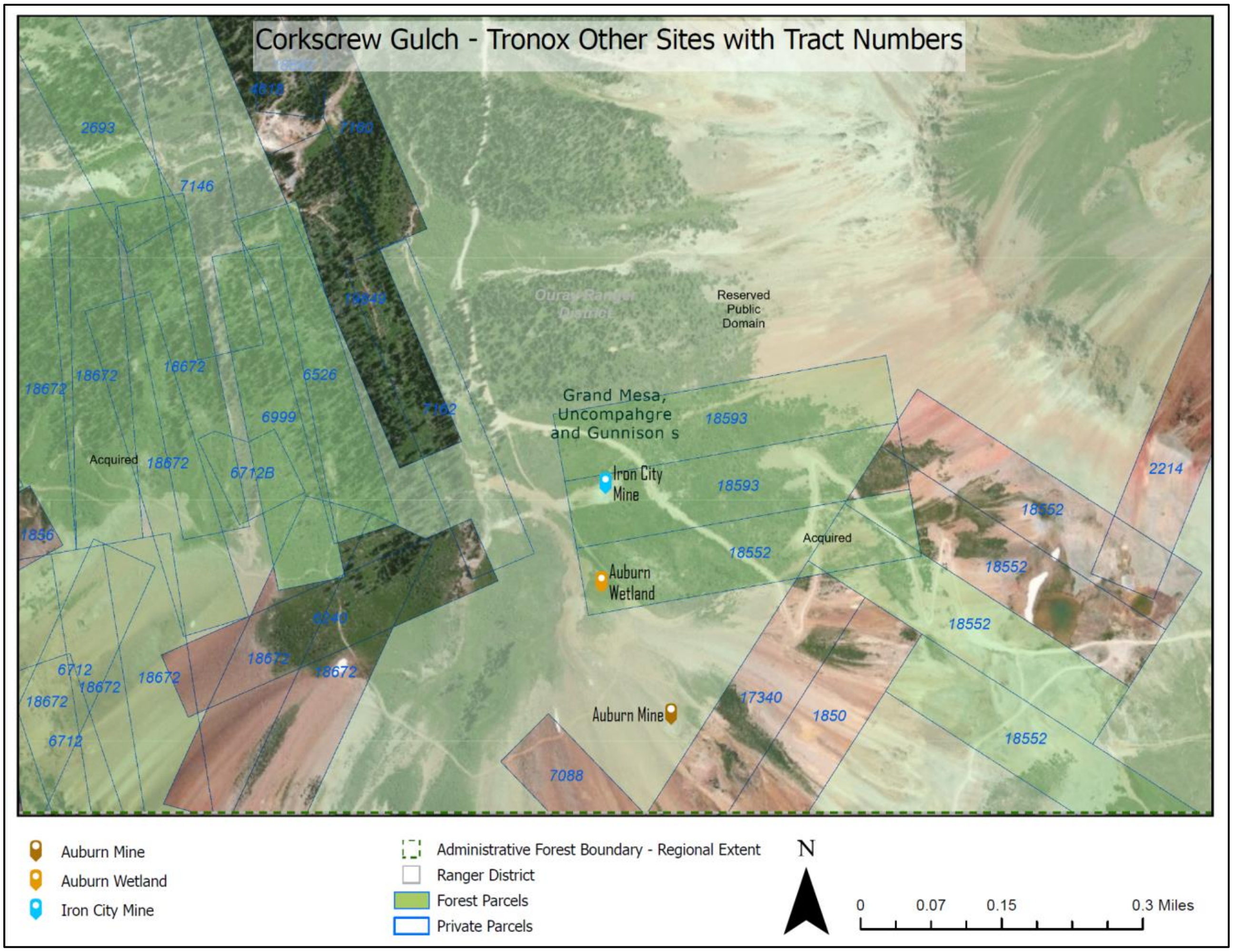


Figure 2: Regional Map of Corkscrew Gulch

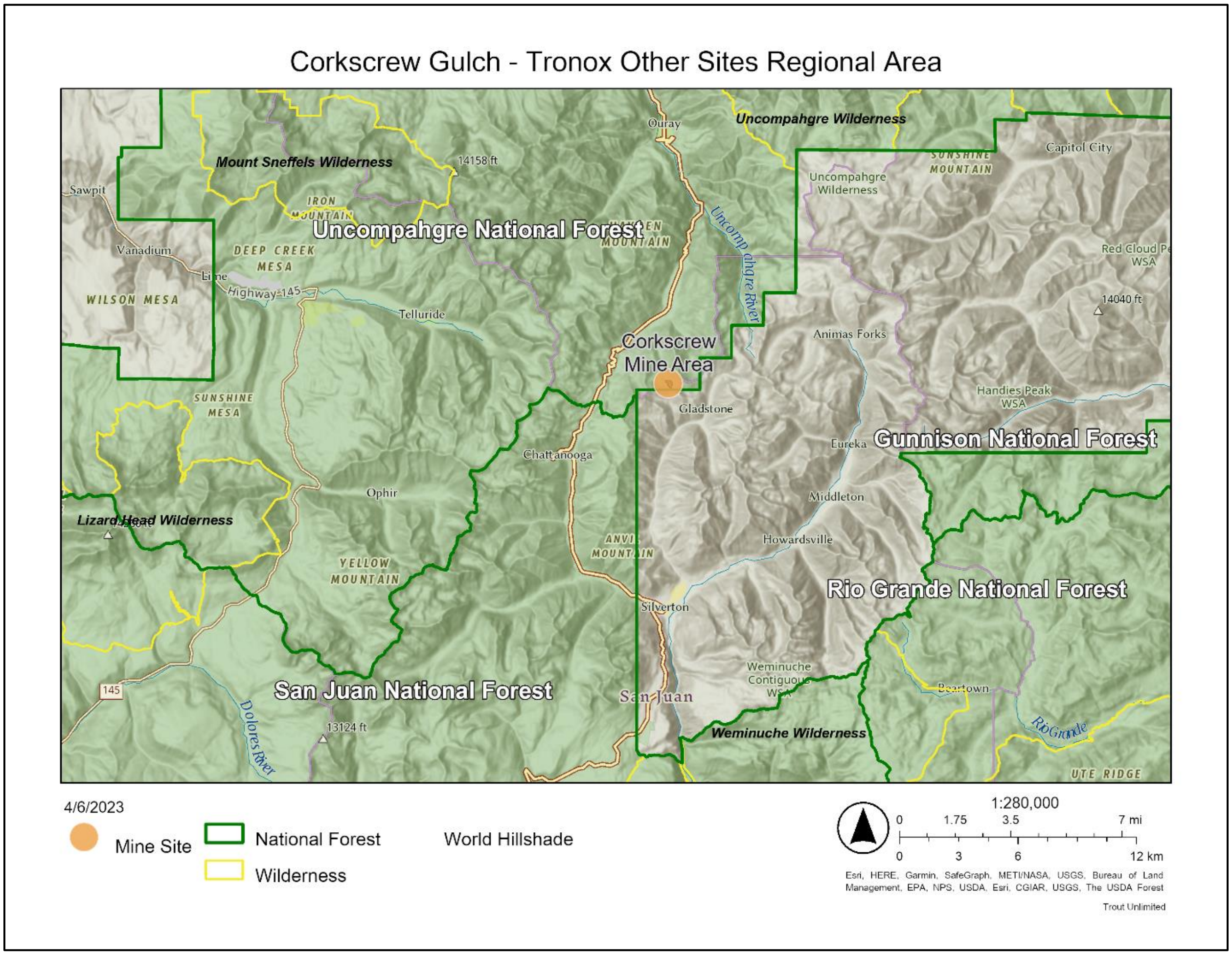


Figure 1: Identifies approximate boundaries of different features within the site

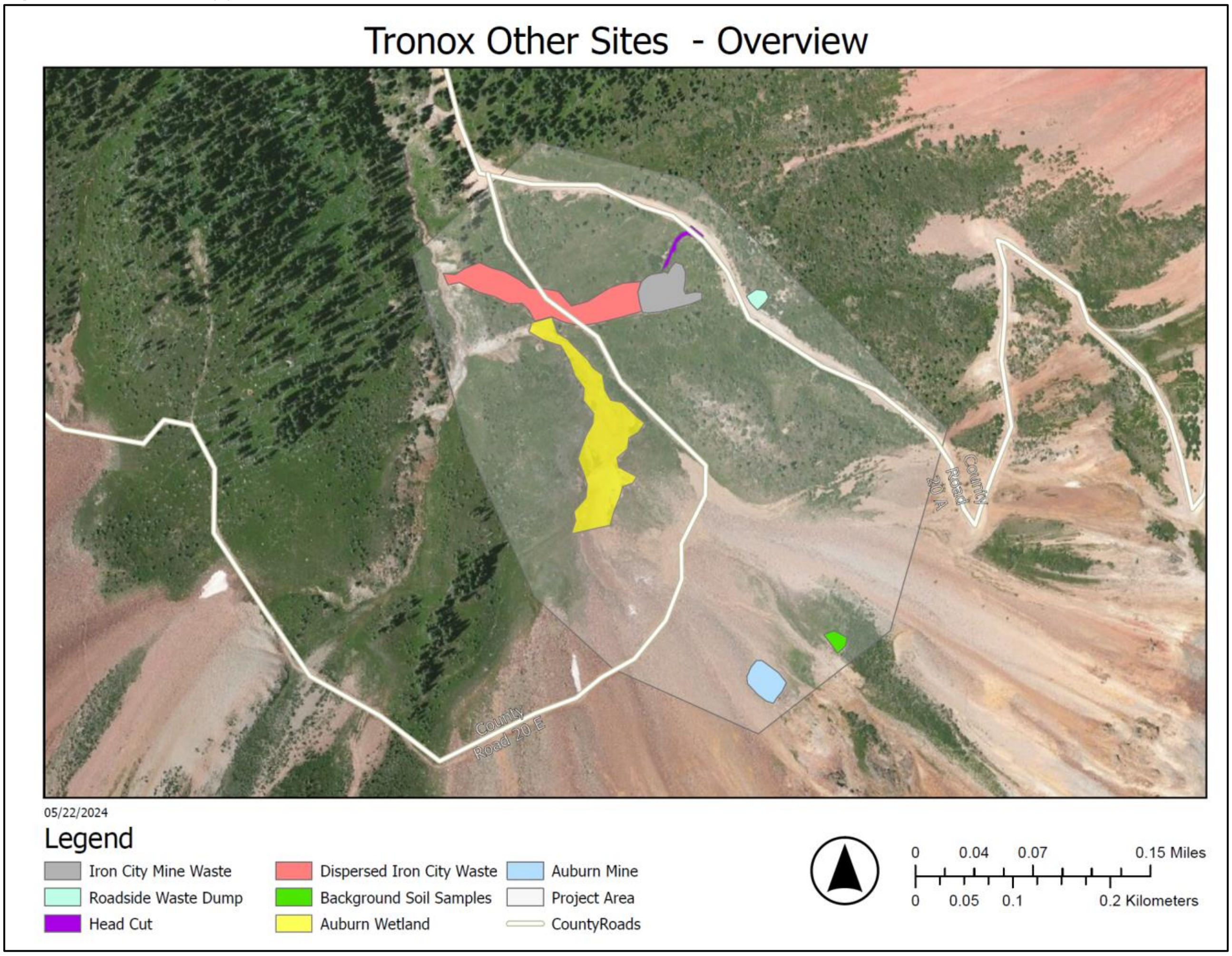


Figure 2: Illustrates the Site location in comparison to localized features and the historic town of Ironton

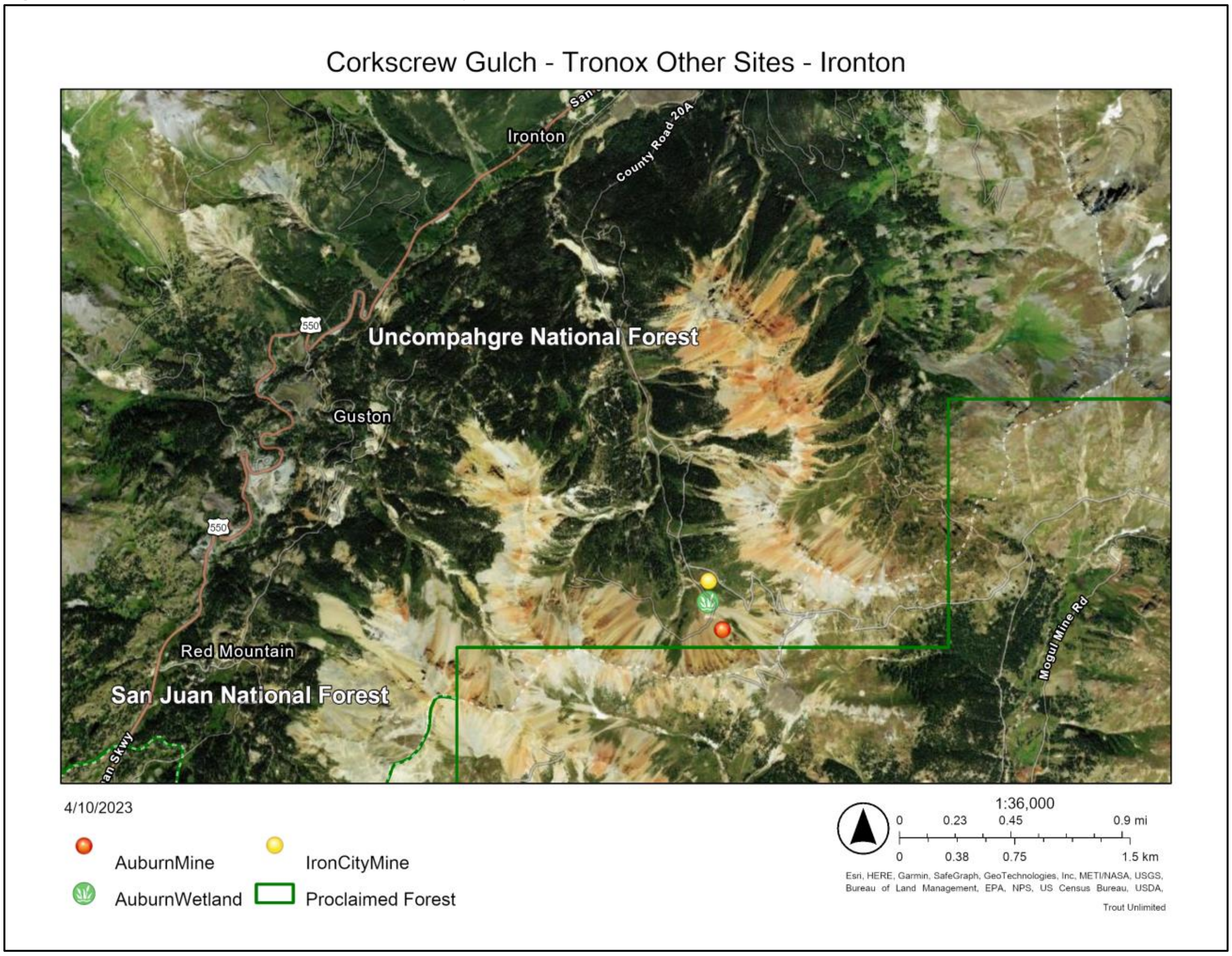


Figure 3: USGS 2019 (US Topo) Ironton, CO quadrangle 1:24000. The red star denotes Site location

Figure 4: Colorado surface water segmentation map, sourced from CDPHE. The red star denotes the Site location

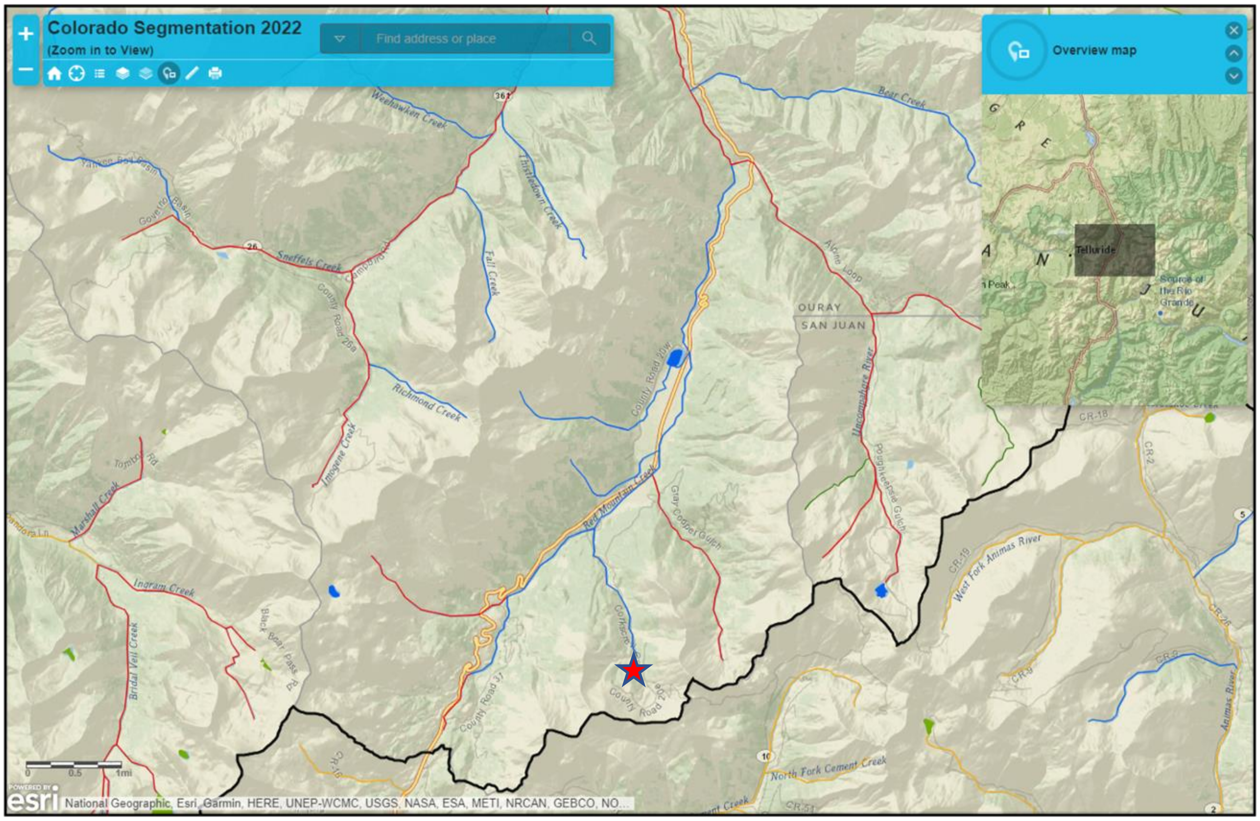


Figure 5: PA/SI sample locations; results are presented in Table 1 through Table 7

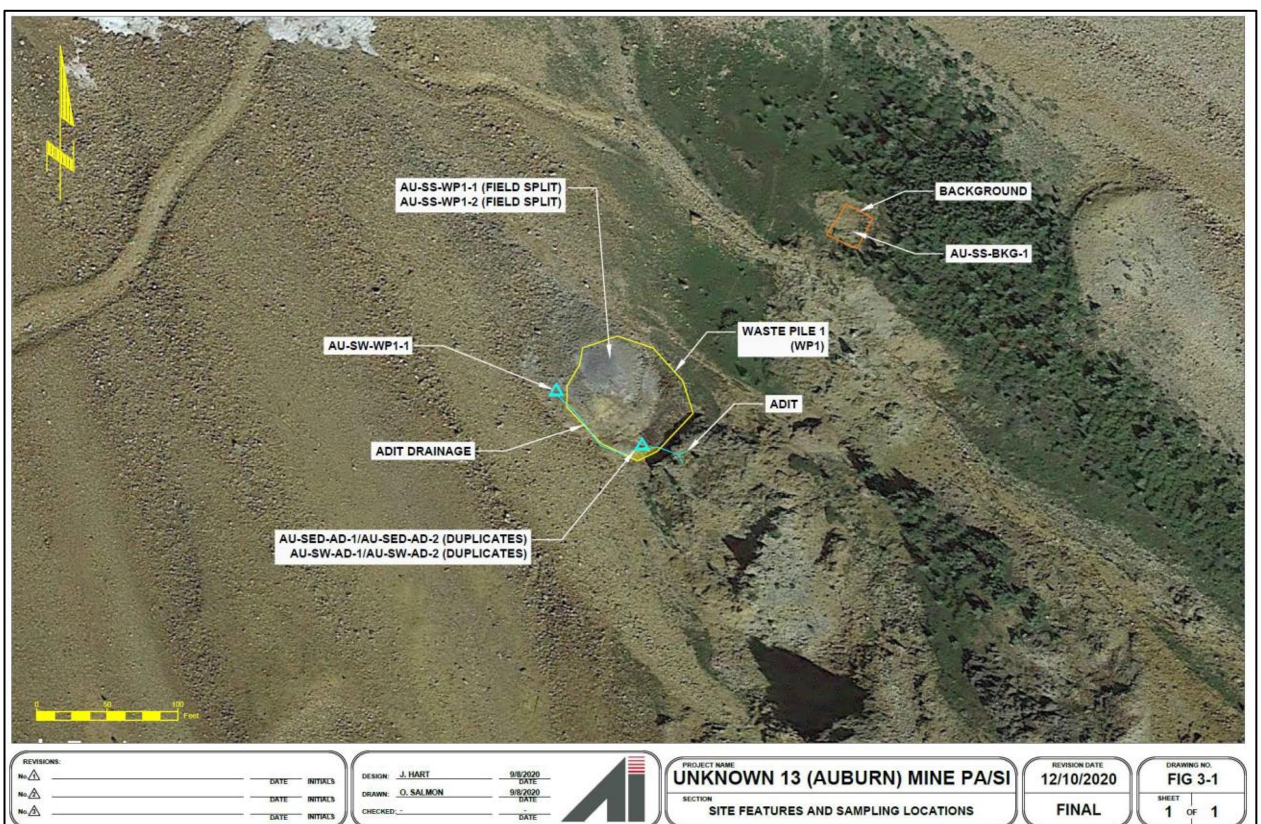


Figure 6: Depicts the Auburn Wetland soil sample locations that comprise the 30-point composite. The sites associated with this EE/CA are depicted as a reference

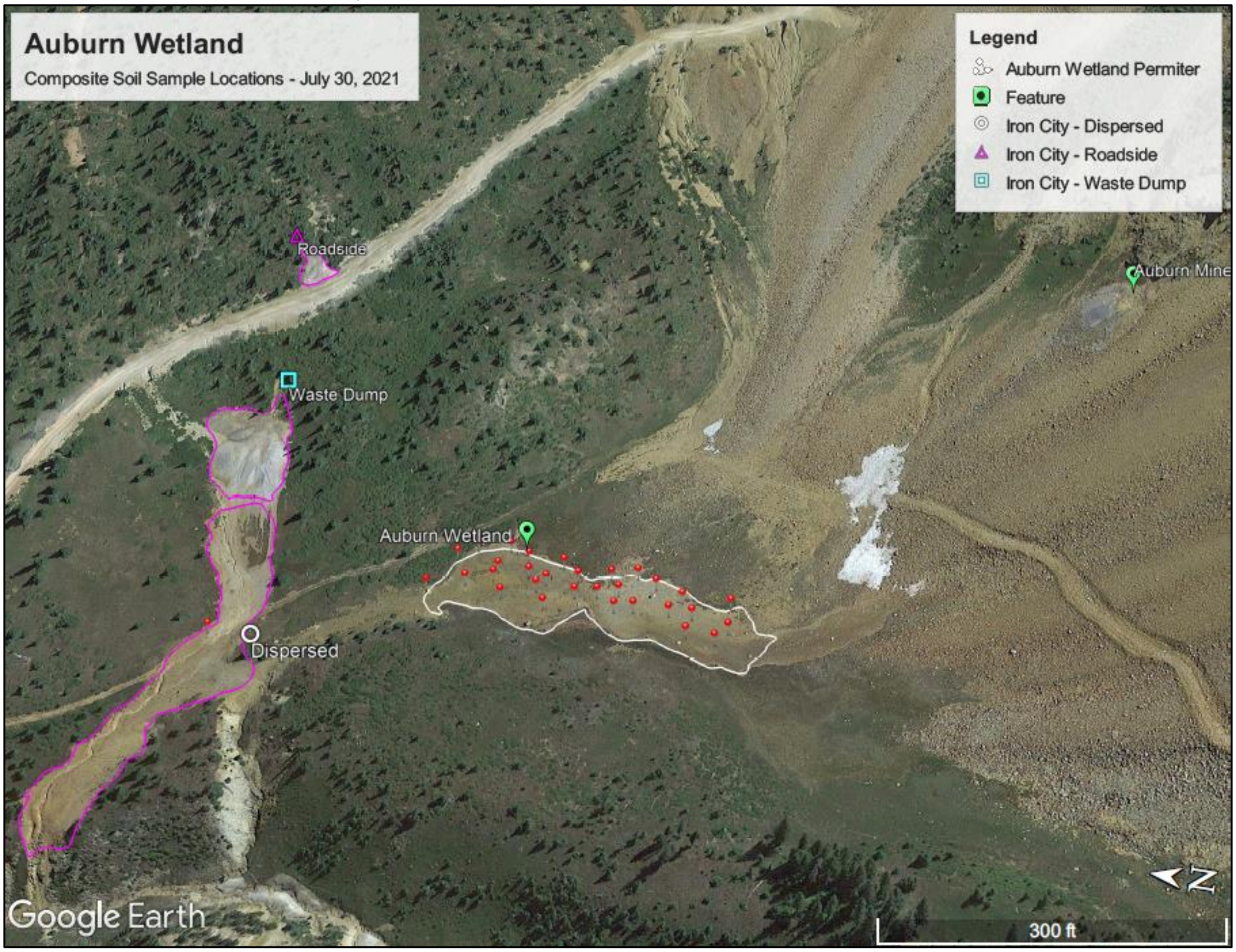
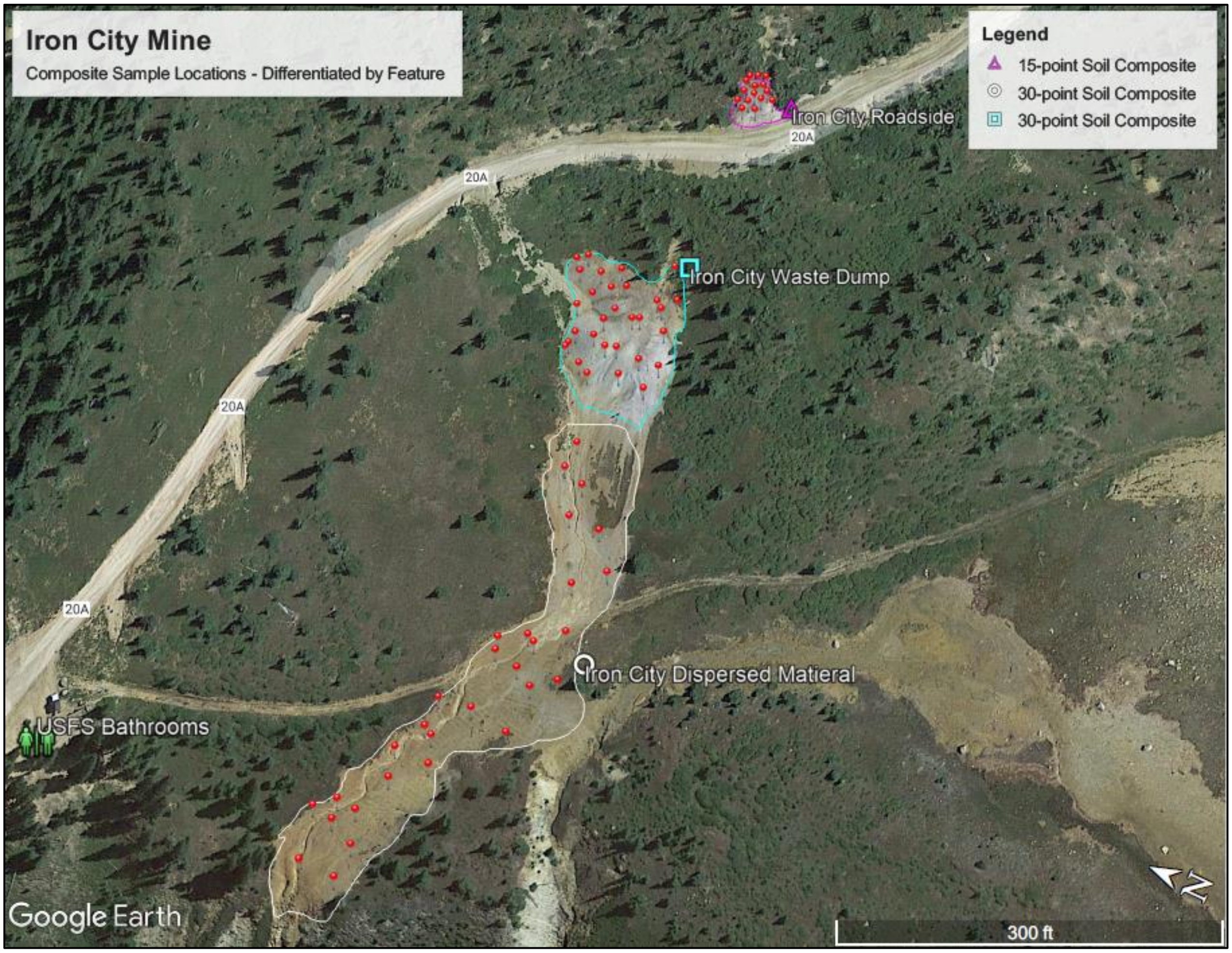


Figure 9: Iron City Mine features, site perimeter, and sampling locations, collected July 26th, 2021



Appendix A – Removal Action Cost Estimates

Alternative 1: On-site Repository, Cap & Cover, In-situ Stabilization & Revegetation, Diversions					
Task	**Description**	**Unit**	**Rate**	**Quantity**	**Cost**
Mine Waste Material Consolidation and	Consolidate loose mine waste and grade features	CY	$ 15.50	4250	$ 65,875.00
Roadside Regrading and Engineered Wall	Regrade, generate and backfill the Roadside Feature with 650 CY of material, including d50 24"	CY	$ 64.00	650	$ 41,600.00
Surface Water Controls - Excavation	Excavation of Surface Water Channels	LF	$ 74.00	950	$ 70,300.00
Surface Water Controls - Construction	Generate and Haul Riprap	CY	$ 105.00	450	$ 47,250.00
Auburn Mine Rock Cap	Generate 70 CY or riprap to cap Auburn Waste Dump	Lump Sum	$ 2,900.00	10	$ 29,000.00
Repository Construction	Excavate Repository	Sq Ft	$ 9.00	22500	$ 202,500.00
Road Work	Rolling Dip; Reshape road surface to be insloped 4-6% between rolling dips	Each	$ 6,500.00	2	$ 13,000.00
Soil Amendments	Purchase, Haul and Install Soil Amendments	Acre	$11,600.00	3	$ 34,800.00
Revegetation	Native Seed Mixture	Acre	$ 650.00	6	$ 3,900.00
Erosion Control Materials	Wattles, Biodegradable Mats, Wood Straw	Lump Sum	-	-	$ 8,358.00

20 % Contingency -- Construction Costs	$ 103,316.60
Construction Subtotal	*$ 619,899.60*

Equipment Mobilization	Mobilization and Demobilization (Equiment & Fuel)	Lump Sum	-	-	$ 120,000.00
Contracted Costs	Lodging, Per Diem, Travel	Lump Sum	-	-	$ 31,200.00
Project Management	Work Plan, Site HASP, Contrustion Control Plan, Oversight of Construction	Lump Sum	-	-	$ 29,170.50

10 % Contingency -- Project Oversight	$ 18,037.05
Project Mangement and Contracting Costs Subtotal	*$ 198,407.55*

Total Estimated Cost to Implement Alternative 1	***$ 818,307.15***

Alternative 2: Repository Adjacent to Mine-impact Footprint, In-situ Amendments & Revegetation, Diversions					
Task	**Description**	**Unit**	**Rate**	**Quantity**	**Cost**
Material Consolidation and Excavation	Consolidate loose mine waste and grade features	CY	$ 15.50	4250	$ 65,875.00
Roadside Regrading and Engineered Wall	Regrade, generate and backfill the Roadside Feature with 650 CY of material, including d50 24"	CY	$ 64.00	650	$ 41,600.00
Surface Water Controls - Excavation	Excavation of Surface Water Channels	LF	$ 74.00	950	$ 70,300.00
Surface Water Controls - Construction	Generate and Haul Riprap for 950 linear feet	CY	$ 105.00	450	$ 47,250.00
Auburn Mine Rock Cap	Excavate 66 CY or riprap to cap Auburn Waste Dump	Lump Sum	$ 2,900.00	10	$ 29,000.00
Repository Construction	Excavate Repository	Sq Ft	$ 9.00	22500	$ 202,500.00
Road Work	Rolling Dip; Reshape road surface to be insloped 4-6% between rolling dips	Each	$ 6,500.00	2	$ 13,000.00
Soil Amendments	Purchase, Haul and Install Soil Amendments	Acre	$11,600.00	4	$ 46,400.00
Revegetation	Native Seed Mixture	Acre	$ 650.00	8	$ 5,200.00
Erosion Control Materials	Wattles, Biodegradable Mats, Wood Straw	Lump Sum	-	-	$ 14,568.00

20 % Contingency -- Construction Costs	$ 107,138.60
Construction Subtotal	*$ 642,831.60*

Mobilization	(Equipment & Fuel)	Lump Sum	-	-	$ 120,000.00
Contracted Costs	Lodging, Per Diem, Travel	Lump Sum	-	-	$ 35,100.00
Project Management	Work Plan, Site HASP, Contrustion Control Plan, Oversight of Construction	Lump Sum	-	-	$ 27,970.50

10 % Contingency -- Project Oversight	$ 18,307.05
Project Mangement and Contracting Costs Subtotal	*$ 201,377.55*

Total Estimated Cost to Implement Alternative 2	***$ 844,209.15***

Alternative 3: On-site Repository of all Mine-impacted Soils, Cap and Cover, In-situ Stabilization & Revegetation,					
Task	**Description**	**Unit**	**Rate**	**Quantity**	**Cost**
Mine Waste Material Consolidation and	Consolidate loose mine waste and grade site features	CY	$ 15.50	5140	$ 79,670.00
Conveyance from Auburn Mine	Haul building materials and construct a conveyance system.	LF	$ 100.00	325	$ 32,500.00
Roadside Regrading and Engineered Wall	Regrade, generate and backfill the Roadside Feature with 650 CY of material, including d50 24"	CY	$ 64.00	650	$ 41,600.00
Surface Water Controls - Excavation	Excavation of Surface Water Channels	LF	$ 74.00	950	$ 70,300.00
Surface Water Controls - Construction	Generate and Haul Riprap for 950 linear feet	CY	$ 105.00	750	$ 78,750.00
Auburn Mine Rock Cap	Generate 70 CY or riprap to cap Auburn Waste Dump	Lump Sum	$ 3,500.00	10	$ 35,000.00
Repository Construction	Excavate Repository	Sq Ft	$ 3.50	26000	$ 210,800.00
Road Work	Rolling Dip; Reshape road surface to be insloped 4-6% between rolling dips	Each	$ 6,500.00	2	$ 13,000.00
Soil Amendments	Amendments	Acre	$11,600.00	3	$ 34,800.00
Revegetation	Native Seed Mixture	Acre	$ 650.00	6	$ 3,900.00
Erosion Control Materials	Wattles, Biodegradable Mats, Wood Straw	Lump Sum	-	-	$ 8,358.00

20 % Contingency -- Construction Costs	$ 121,735.60
Construction Subtotal	*$ 730,413.60*

Equipment Mobilization	Mobilization and Demobilization (Equiment & Fuel)	Lump Sum	-	-	$ 135,000.00
Contracted Costs	Lodging, Per Diem, Travel	Lump Sum	-	-	$ 54,600.00
Project Management	Work Plan, Site HASP, Contrustion Control Plan, Oversight of Construction	Lump Sum	-	-	$ 29,170.50

10 % Contingency -- Project Oversight	$ 21,877.05
Project Mangement and Contracting Costs Subtotal	*$ 240,647.55*

Total Estimated Cost to Implement Alternative 3	***$ 971,061.15***

Alternative 4: Off-site Repository, In-situ Amendments & Revegetation, Diversions					
Task	**Description**	**Unit**	**Rate**	**Quantity**	**Cost**
Material Consolidation and Excavation	Consolidate loose mine waste and grade features	CY	$ 15.50	5140	$ 79,670.00
Conveyance from Auburn to access road	Haul building materials and construct a conveyance system.	LF	$ 100.00	325	$ 32,500.00
Haul Material to Ironton - Hauled with Load & 5 yrd bucket **(approximately**	Transport the estimated 5760 CY of mine waste from the Roadside feature to the Ironton Parking Area. **38 hauling days at 6 trips/day**	Hauling Days	$ 7,500.00	38	$ 285,000.00
Haul Material (Ironton to Montrose Landfill)	Transport the estimated mine waste from the Roadside feature (374 trips @ 102 miles round trip)	Hauling Days	$ 1,600.00	111	$ 177,600.00
Hazardous Material Disposal	Montrose Landfill Dump Cost	Tons	$ 65.00	4114	$ 267,428.57
Site Regrading	Regrade, generate and backfill the Roadside Feature with 650 CY of material, including d50 24"	Acre	$ 4,200.00	5	$ 21,000.00
Road Work	Rolling Dip; Reshape road surface to be insloped 4-6% between rolling dips	Each	$ 5,500.00	2	$ 11,000.00
Controls - Excavation	Excavation of Surface Water Channels	LF	$ 74.00	950	$ 70,300.00
Surface Water Controls - Construction	Generate and Haul Riprap for 950 linear feet	CY	$ 105.00	450	$ 47,250.00
Soil Amendments	Purchase, Haul and Install Soil Amendments (Auburn Wetland & Iron City Site	Acre	$11,600.00	5	$ 58,000.00
Revegetation	Native Seed Mixture	Acre	$ 650.00	6	$ 3,900.00
Erosion Control Materials	Wattles, Biodegradable Mats, Wood Straw	Lump Sum	-	-	$ 10,358.00
20 % Contingency -- Construction Costs					$ 212,801.31
Construction Subtotal					*$ 1,276,807.89*
Equipment Mobilization	Mobilization and Demobilization (Equipment & Fuel)	Lump Sum	-	-	$ 135,000.00
Contracted Costs	Lodging, Per Diem, Travel	Lump Sum	-	-	$ 117,570.00
Project Management	Work Plan, Site HASP, Contrustion Control Plan, Oversight of Construction	Lump Sum	-	-	$ 27,970.50
10 % Contingency -- Project Oversight					$ 28,054.05
Project Mangement and Contracting Costs Subtotal					*$ 308,594.55*
Total Estimated Cost to Implement Alternative 4					***$ 1,585,402.44***

Alternative 5: No Action					
Task	**Description**	**Unit**	**Rate**	**Quantity**	**Cost**
No On-site Remedial Actions	This Alternative would elect to leave the all features described in the EE/CA in their current state	NA	NA	0	$ -
Total Estimated Cost to Implement Alternative 5					***$ -***

Appendix B – State and Federal ARARs

Standard and Regulatory Citation		Status	Description	Comment	Chemical	Location	Action
				Federal			
1	Federal Water Quality Criteria 40 CFR 131	Potentially Applicable	Sets standards for surface water to protect aquatic organisms and human health.	The primary Removal action goal is to stabilize contaminated material on-site, while reducing ability of that material to migrate or be mobilized off-site. Additional benefits of the project for Corkscrew Gulch will be improvement of water quality and reduction in potential sediment load	☒	☒	☐
2	Clean Water Act 33 USC 1251-1387 Chapter 26	Potentially Applicable	Objective is to restore and maintain the quality of surface waters by restricting discharges of all designated pollutants, which include 126 "priority toxic pollutants" various "conventional pollutants" and certain "non-conventional pollutants".	The primary Removal action goal is to stabilize contaminated material on-site, while reducing ability of that material to migrate or be mobilized off-site. Therefore, improvement of water quality in Corkscrew Gulch would be a secondary benefit of the project.	☒	☒	☐
3	Endangered Species Act 316 USC § 1531 (h) through 1543 40 CFR Part 6.302 50 CFR Part 402	Potentially Applicable	Act to protect habitat of endangered and threatened species. Activities may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat.	Site activities are expected to have minimal impact of wildlife in site footprint and adjacent areas. 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. Procedural and enforcement provisions may not apply onsite at an USFS CERCLA removal action.	☐	☒	☐
4	Fish and Wildlife Coordination Act 16 USC 1251 661 et seq.; 40 CFR 6.302(g)	Applicable	Requires consultation when Federal agency proposes or authorizes any modification of any stream or other water body to assure adequate protection of fish and wildlife resources.	Wildlife and fisheries in Corkscrew Gulch will be enhanced by this work	☐	☒	☒
5	Historic Sites, Buildings, and Antiques Act and Executive Order 11593 16 USC 461 et seq.; 40 CFR Part 6.301	Applicable	EPA is subject to the requirements of the Historic Sites Act of 1935, 16 U.S.C. 461 et seq., the National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq., the Archaeological and Historic Preservation Act of 1974, 16 U.S.C. 469 et seq., and Executive Order 11593, entitled Protection and Enhancement of the Cultural Environment.	Substantive compliance with NHPA requirements satisfies this requirement. A historical investigation of the Site and surrounding area has a finding of no significant impact regarding planned removal actions. This investigation covered both private and FS lands. Procedural and enforcement provisions do not apply on-site at a USFS CERCLA removal action.	☐	☒	☐
6	Migratory Bird Treaty Act 16 USC §§ 703 et seq.	Potentially Applicable	Establishes federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the US Fish and Wildlife Service during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds.	Bird migrations are typical of the region.	☐	☒	☐
7	National Environmental Policy Act 7 CFR 799 (1969) http://www.epa.gov/region9/nepa/	Potentially Applicable	Section (102)(2) of NEPA requires all Federal agencies to give appropriate consideration to the environmental effects of their proposed actions. The Council on Environmental Quality regulations at 40 CFR 1507.3(b) identify those items which must be addressed in agency procedures.	Wildlife, fisheries, cultural resources will be considered through the CERCLA process and not under NEPA. This is process will be covered as outlined under the doctrine of functional equivalence.	☐	☒	☐

	Standard and Regulatory Citation	Status	Description	Comment	Chemical	Location	Action
8	Protection of Wetlands Order, Executive Order 11990 40 CFR Part 6	Applicable	Requires minimizing and avoiding adverse impacts to wetlands.	The Auburn Wetland has not formally been delineated, but this depression that hosts seasonal surface water will be enhanced as part of the proposed remedial action.	☐	☒	☒
9	Floodplain Management, Executive Order 1198842 USC 4321 et seq.; 42 USC 4001 et seq.	Potentially Applicable	Requires evaluating the potential effects of actions that may take place in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.	No remediation activities will take place in floodplain habitat	☐	☒	☐
10	Archaeological Resources Protection Act (ARPA) 16 USC Section 470 et. Seq. 40 CFR Part 7	Potentially Applicable	ARPA and implementing regulations prohibit the unauthorized disturbance of archaeological resources on public and Indian Lands. Archaeological resources are any material remains of past human life and activities which are of archaeological interest. Removal of archaeological resources from public or Indian lands is prohibited and any archaeological investigations at a site must be performed by a professional archaeologist. ARPA and implementing regulations are applicable for the conduct of any elected response action that may result in ground disturbance.	Substantive compliance with NHPA requirements satisfies this requirement. A historical investigation of the Site and surrounding area has a finding of no significant impact regarding planned removal actions. This investigation covered both private and FS lands. Procedural and enforcement provisions do not apply on-site at a USFS CERCLA removal action.	☐	☒	☐
11	National Historic Preservation Act (NHPA) 16 USC Section 470f 36 CFR Parts 60, 63, and 800 40 CFR Section 6.301	Applicable	Section 106 of NHPA process balances needs of federal undertaking with effects the undertaking may have on historic properties.	Substantive compliance with NHPA requirements satisfies this requirement. A historical investigation of the Site and surrounding area has a finding of no significant impact regarding planned removal actions. This investigation covered both private and FS lands and has been signed off on by the State Historical Preservation Office.	☐	☒	☐
12	Bevill Amendment RCRA Section 3001 (a)(3)(A)(ii) 42 USC 6921 (a)(3)(A)(ii) 40 CFR Section 261.4(b)(7)	To be considered	Exempts most mining wastes from regulation as hazardous waste. Exempted waste includes waste from the extraction and beneficiation of minerals, and some mineral processing waste.	Further, onsite consolidation of Bevill-exempt section 3001(b)(3)(A), mining-related rock and tailings onsite at a CERCLA removal action does not constitute generation nor placement of solid wastes and is not creating a regulated landfill. The Site removal action is to be designed and constructed not as hazardous waste facility, but as a naturally functioning landscape with a native vegetated cover. Further, USFS may implement any/all of the following actions to provide long-term sustainable CERCLA remedies: - Amend the Forest's Land Status Atlas to reflect the location of any engineered feature that should remain undisturbed, - Amend the Forest Service's Geographic Information System (GIS), Combined Data System (CDS), Land Status Record System (LSRS) [and/or any other mapping systems that function as the official record of National Forest System land] to note the location of the feature, - Perform periodic inspections of the engineered feature, in order to photograph and document whether it is performing as desired, - Make an administrative amendment to the Forest Plan to note the location of the feature, and to implement any restrictions that are allowed by law, such as restrictions on buildings, water supply wells or utility lines, - Make an administrative amendment to the Forest Plan to note that any sale or transfer of the Site or the feature would have to meet the requirements of CERCLA 42 USC 9620(h).	☐	☐	☒
13	Federal Land Policy and Management Act of 1976 43 USC 1701 et seq.	Applicable	Governs the way in which the public lands administered by the USFS are managed.	USFS staff are involved in the project.	☐	☐	☒
14	Federal Watershed Restoration and Enhancement Agreement (Wyden Amendment) 16 USC 1011	Appropriate	Allows the Secretary of the Interior for the purpose of entering into cooperative agreements with the heads of other Federal agencies, Tribal, State, and local governments, private and nonprofit entities, and landowners for the protection, restoration, and enhancement of fish and wildlife habitat and other resources on public or private land and the reduction of risk from natural disaster where public safety is threatened that benefit these resources on public lands within the watershed.	Project is a scheduled to take place on Federal Lands, and at this point, will be governed by the USDA's Forest Service.	☐	☐	☒

15	Clean Air Act National Primary and Secondary Ambient Air Quality Standards National Emission Standards for Hazardous Air Pollutants 42 USC 7409 40 CFR Part 50 40 CFR Part 61, Subparts N, O, P, pursuant to 42 USC 7412	Relevant and Appropriate pertaining to disturbance of waste material during consolidation, removal, or treatment.	Establish air quality levels that protect public health, sets standards for air emissions. Regulates emissions of hazardous chemicals to the atmosphere.	Project will cause minimal and temporary disturbance during construction.	☐	☐	☒
16	Floodplain Management Executive Order No. 11988	To be considered	Requires Federal agencies to consider alternatives to avoid, to the extent possible, adverse effects and incompatible development in the floodplain.	Project intends to improve flood management in the formerly mined area and nexus at the USFS Road, Corkscrew Pass	☐	☐	☒
17	Protection of Wetlands Executive Order No. 11990.	To be considered	Requires Federal agencies to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative	Wetlands disturbance not anticipated.	☐	☐	☐
18	National Forest Management Act of 1976". (16 U.S.C. 1600)	Applicable	Written as the primary statute governing the administration of national forests and was an amendment to the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on national forest lands.	Some of the work will be performed on National Forest Service lands.	☐	☐	☐
19	Grand Mesa, Uncompahgre, Gunnison National Forest Proposed Land Management Plan (March 2007)	Applicable to USFS Lands	Addresses a number of national forest-specific requirements for USFS lands within GMUG, including recreation, species diversity, scenery, etc.	Work performed on National Forest Service Lands will take into consideration the GMUG Land Management Plan	☐	☐	☐
20	Best Management Practices for Soils Treatment Technologies EPA OSWER, 1997	To be considered	Provides technologies for controlling cross-media transfer of contaminants during materials handling activities.	Special conditions for the management of waste rock and mill tailings material are not anticipated.	☐	☐	☐
21	Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites	To be considered	Suggests levels for lead in soil. This factor would be considered if lead is found in elevated levels in soils remaining after contaminant removal.	The site is not a Superfund Site. Elevated concentrations of lead may exist in tailings materials left on site.	☐	☐	☐

STATE/LOCAL							
	Standard and Regulatory Citation	Status	Description	Comment	Chemical	Location	Action
22	Colorado Basic Standards & Methodologies for Surface Water, 5 CCR 1002-31, pursuant to C.R.S. § 25-8-101 *et seq.*	Potentially Applicable	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 non-degradation standard.	There is not a stream that flows through Auburn Mine or Iron City Mine. However, surface water stemming from snowmelt and seasonal precipitation events surrounding these sites flows into the Corkscrew Gulch, upstream of the historic mining town of Ironton, CO, and 10 miles upstream of Ouray, CO. This stream segment (COGUUN06b_A) is not listed as impaired for any constituents according to the Colorado WQCD. This Segment includes the Mainstem of Red Mountain Creek from immediately above the confluence with the East Fork of Red Mountain Creek to the confluence with the Uncompahgre River. All tributaries to Red Mountain Creek within Corkscrew and Champion basins. **The removal action will accomplish the goal of improving site conditions through in-situ phytostablization, consolidating, capping mine waste, Site revegetation, and decreasing surface water interactions at the site through run-on/run-off diversions. Wetlands and perennial streams will not be negatively impacted by reclamation construction nor will actions seek to attain water quality standards.**	☒	☒	☒

23	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	**Potentially Applicable**	**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.**	Substantive requirement(s) of regulation apply for any release of stormwater off-site. Design will include BMPs that meet substantive requirements of ARAR. These BMPs will include installation of run-on/run-off controls adjacent to revegetated areas and Silt Fences to control surface runoff during construction. Procedural and/or enforcement provisions not applicable onsite at an USFS CERCLA removal action. The Auburn Mine is considered a point source, discharging 22 gpm from the adit portal. The RA Alternatives presented in the EE/CA do not include manipulation of water at the adit due to private ownership of that feature. EE/CA alternatives suggest rerouting drainage around the Auburn Mine waste dump to reduce metals loading and to cap the waste dump feature with native talus to reduce mobilization of material while reducing human health exposure. At no point do the RA alternatives attempt to attain water quality standards. **The activities surrounding the Auburn Mine are less than 1 acre and the surface water at this site only briefly flows on NFS lands momentarily before water resuming flow below the ground surface, thus making not requiring the need for a stormwater permit.**	☒	☒	☐
24	**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.***	**Potentially Applicable**	**Acid forming or toxic producing mined materials must be handled and disposed in a manner that will protect the surface and groundwater drainage system from pollution. This ARAR also regulates all aspects of mining, including location of operations, reclamation, and other environmental and socioeconomic impacts.**	**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 from off-site sources within the footprint of existing CERCLA site boundary. The RA is taking place solely on USFS property and all toxic materials will be stabilized via in-situ soil amendments, capping, or consolidation with a soil and rock cap. Overall, acid-forming materials will decrease as a result of the proposed RAs.**	☒	☐	☒
25	Mined Land Reclamation Board Regulations for Hard Rock, Metal, and Designated Mining Operations,: Reclamation Performance Standards, 2 CCR 407-1 Rule 3.1.8, pursuant to the Colorado Mined Land Reclamation Act, CRS § 34-32-101 *et seq.*	**Potentially Applicable**	**Reclamation activities must take into account 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).**	**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**	☒	☐	☒
26	Colorado Fugitive Dust Control Plan/Opacity, Regulation No. 1., 5 CCR 1001-3, pursuant to Colorado Air Pollution Prevention and Control Act.	**Relevant and Appropriate**	**Requires control measures to manage fugitive emissions from construction activities, storage and stockpiling activities, haul trucks and tailings ponds.**	**Substantive requirements of dust control/opacity will be included during implementation of RA due to placement, grading, amending, and subsequent revegetation activities onsite. 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.**	☐	☒	☒
27	**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.*	**Relevant and Appropriate**	**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**	**Substantive reclamation requirements may be relevant and appropriate at the Auburn Mine and Iron City Mine sites due to the capping of mine waste, in-situ phytostabilization and revegetation of mine wastes on-site. Procedural and/or enforcement aspects of MLRB Regulations are not applicable onsite at an USFS CERCLA removal action.**	☒	☒	☐
28	**MLRB Regulations Rule 3.1.5(1), (3), and (7)**	**Applicable**	**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.**	Substantive requirements are applicable on-site due to the regrading and consolidation of mine waste. However, procedural and/or enforcement aspects of MLRB Regulations are not applicable onsite at an USFS CERCLA removal action. The removal action is intended to reduce surface water residence time on-site and minimize interactions with mineralized soils, decreasing dissolved metals and reducing mobilized metal-laden sediment to receiving waters.		☒	

29	MLRB Regulations Rule 3.1.5(2)	**Potentially Applicable**	**Backfilling shall ensure adequate compaction for stability and prevent leaching of toxic or acid forming materials.**	**Any consolidation and compaction of mine wastes/tailings could potentially apply. However, the grading plan will ensure adequate compaction combined with minimizing the mobilization of material offsite which is the main removal action goal.** **Groundwater is outside of the scope of this USFS CERCLA removal action and affects from leaching are not considered.**	☐	☒	☒
31	MLRB Regulations Rule 3.1.6	**Not Applicable**	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	There are no dredge and fill operations associated with this project, as well as siltation structures. **There are no anticipated disturbances planned to the hydrologic balance at the site. Therefore, procedural and/or enforcement aspects of MLRB Regulations are not applicable onsite at an USFS CERCLA removal action.**	☐	☒	☒
32	MLRB Regulations Rule 3.1.7	**Not Applicable**	Reclamation activities that may affect the quality **of any groundwater must comply with all state-wide groundwater quality standards and standards for classified areas. For unclassified areas, reclamation activities must protect the existing and reasonably potential future uses of such groundwater.**	Groundwater is outside of the scope of this USFS CERCLA removal action. The primary Removal action goal is to stabilize contaminated material on-site, while reducing ability of that material to migrate or be mobilized off-site.	☐	☒	☒
33	**MLRB Regulations Rule 3.1.8**	**Potentially Applicable**	**Reclamation activities must take into account 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).**	**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.**	☐	☒	☒
34	**Colorado Noxious Weed Act and Ouray County Noxious Weed regulations, CRS § 35-5.5-101-119; 8 CCR 1206-2**	**Applicable**	**Colorado regulations addressing management of noxious weeds.**	Revegetation activities will include use of certified weed-free native seed mix, as well as weed-free sources of straw and wood straw products that are common in reclamation. **The entity overseeing the implementation of the RA alternative will mandate clean equipment after a thorough equipment inspection prior to mobilization to the RA Site.**	☐	☒	☒
35	**Colorado Wildlife Enforcement and Penalties Act, CRS §§ 33-6-101 to 130.**	**Potentially Applicable**	**Prohibits actions detrimental to wildlife, and establishes provisions governing the taking, possession, hunting and use of wildlife and migratory birds.**	**Site activities are expected to have minimal impact of wildlife in site footprint and adjacent areas.** **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.** **Procedural and enforcement provisions may not apply onsite at an USFS CERCLA removal action.**	☐	☒	☒
36	**Colorado Non-game, Endangered, or Threatened Species Act, CRS §§ 33-2-101-108**	**Potentially Applicable**	**Protects endangered and threatened species and preserves their habitats. Requires coordination with the Colorado Parks and Wildlife if removal activities impact nongame wildlife deemed to be in need of management.**	**Site activities are not expected to have a long-term impact to threatened species. T&E species habitat should be improved through removal action goal implementation.** **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.** **Procedural and enforcement provisions may not apply onsite at an USFS CERCLA removal action.**	☐	☒	☒

37	Colorado Wildlife Commission Regulations, 2 CCR 406, pursuant to CRS §§ 33-2-101-108	Potentially Applicable	Establishes specific requirements for protection of wildlife.	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. Procedural and enforcement provisions may not apply onsite at an USFS CERCLA removal action.	☐	☒	☒
38	Colorado Historic Preservation Regulations, 8 CCR 1504-7, pursuant to CRS 24-80-401 to 410, and 1301 to 1305.	Applicable	Establishes requirements for protecting properties of historical significance; establishes procedures and requires a permit for investigation, excavation, gathering, or removal from the State of any historical, prehistorical, or archeological resources on State Lands. Requires an excavation permit and notification if human remains are found on State Lands. Note: The National Historic Preservation Act is more stringent.	Substantive compliance with NHPA requirements satisfies this requirement. A historical investigation of the Site and surrounding area has a finding of no significant impact regarding planned removal actions. This investigation covered both private and FS lands. Procedural and enforcement provisions do not apply on-site at a USFS CERCLA removal action.	☐	☐	☒
39	Colorado Primary and Secondary Ambient Air, 5 CCR 1001-14, pursuant to CRS 25-7-108	Potentially Applicable	Sets ambient air quality standards for a variety of constituents, including particulate matter and lead.	Appropriate BMPs will be utilized during RA activities at the site to minimize any generation of dust or other particulate matter.	☒	☒	☐

Appendix C – Photo Documentation

Auburn Mine – TU Site Characterization. Property boundary line indicated by yellow sign on red stake. 7/26/23.

Auburn Mine – TU Site Characterization, 7/26/23

Auburn Mine Portal: PCS Field Assessment, 7/25/20

Auburn Mine – PA/SI Characterization, 7/25/20

Auburn Mine – PA/SI Characterization, 7/25/20

Auburn Mine and Wetland from top of Corkscrew Gulch – USFS Site Visit, 7/29/23

Auburn Wetland – USFS Site Visit, 7/29/23

Auburn Mine (bottom right), Auburn Wetland (foreground) and the Iron City Mine features (center) with Corkscrew Gulch Road (County Road 20A) – USFS Site Visit, 7/29/23

Auburn Wetland outlet with the Auburn Mine in the background, from access road – TU Site Characterization, 7/26/23

Iron City Mine Dump and Roadside – TU Site Characterization, 7/26/23

Iron City Waste Dump from Corkscrew Gulch Road (County Rd 20A) – TU Site Characterization, 7/26/23

Iron City Waste Dump – TU Site Characterization, 7/26/23

Photo taken from the Iron City Dispersed feature, with the Waste Dump (center) and Roadside (background) – TU Site Characterization, 7/26/23

Erosion on Corkscrew Gulch Road above the Iron City Waste Dump – USFS Site Visit, 7/29/23

Corkscrew Gulch Road washout above the Iron City Waste Dump – USFS Site Visit, 7/29/23

Corkscrew Pass Road washout above the Iron City Waste Dump – USFS Site Visit, 7/29/23

Appendix D – Lab Reports

ACZ Laboratories, Inc.

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

Inorganic Analytical Results

Trout Unlimited Inc

Project ID:

Sample ID: AUBURN WETLAND

ACZ Sample ID: ***L74897-01***
Date Sampled: *10/05/21 12:25*
Date Received: *07/27/22*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion (1312)	M3010A ICP								08/10/22 18:27	aeh

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum (1312)	M6010D ICP	1	0.163	BH	*	mg/L	0.05	0.25	08/22/22 22:13	aeh
Aluminum, total (3050)	M6010D ICP	102	9190	H	*	mg/Kg	5.1	25.5	08/11/22 1:58	keh1
Arsenic (1312)	M6010D ICP	1	<0.04	UH	*	mg/L	0.04	0.2	08/22/22 22:13	aeh
Arsenic, total (3050)	M6010D ICP	102	90.6	H	*	mg/Kg	4.08	20.4	08/11/22 1:58	keh1
Cadmium (1312)	M6010D ICP	1	<0.008	UH	*	mg/L	0.008	0.025	08/22/22 22:13	aeh
Cadmium, total (3050)	M6010D ICP	102	<0.816	UH	*	mg/Kg	0.816	2.55	08/11/22 1:58	keh1
Chromium (1312)	M6010D ICP	1	<0.02	UH	*	mg/L	0.02	0.05	08/23/22 15:36	aeh
Chromium, total (3050)	M6010D ICP	102	15.5	H	*	mg/Kg	2.04	5.1	08/11/22 1:58	keh1
Copper (1312)	M6010D ICP	1	0.052	H	*	mg/L	0.01	0.05	08/22/22 22:13	aeh
Copper, total (3050)	M6010D ICP	102	177	H	*	mg/Kg	1.02	5.1	08/11/22 1:58	keh1
Iron (1312)	M6010D ICP	1	0.126	BH	*	mg/L	0.06	0.15	08/22/22 22:13	aeh
Iron, total (3050)	M6010D ICP	510	147000	H	*	mg/Kg	30.6	76.5	08/11/22 21:00	keh1
Lead (1312)	M6010D ICP	1	<0.03	UH	*	mg/L	0.03	0.15	08/22/22 22:13	aeh
Lead, total (3050)	M6010D ICP	102	219	H	*	mg/Kg	3.06	15.3	08/11/22 1:58	keh1
Manganese (1312)	M6010D ICP	1	0.030	BH	*	mg/L	0.01	0.05	08/22/22 22:13	aeh
Manganese, total (3050)	M6010D ICP	102	37.9	H	*	mg/Kg	1.02	5.1	08/11/22 1:58	keh1
Nickel (1312)	M6010D ICP	1	<0.008	UH	*	mg/L	0.008	0.04	08/22/22 22:13	aeh
Nickel, total (3050)	M6010D ICP	102	1.11	BH	*	mg/Kg	0.816	4.08	08/11/22 1:58	keh1
Selenium (1312)	M6010D ICP	1	<0.05	UH	*	mg/L	0.05	0.25	08/22/22 22:13	aeh
Selenium, total (3050)	M6010D ICP	102	6.01	BH	*	mg/Kg	5.1	25.5	08/11/22 1:58	keh1
Silver (1312)	M6010D ICP	1	<0.01	UH	*	mg/L	0.01	0.025	08/22/22 22:13	aeh
Silver, total (3050)	M6010D ICP	102	9.50	H	*	mg/Kg	1.02	2.55	08/11/22 1:58	keh1
Zinc (1312)	M6010D ICP	1	<0.02	UH	*	mg/L	0.02	0.05	08/22/22 22:13	aeh
Zinc, total (3050)	M6010D ICP	102	16.2	H	*	mg/Kg	2.04	5.1	08/11/22 1:58	keh1

ACZ Laboratories, Inc.

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

Inorganic Analytical Results

Trout Unlimited Inc

Project ID:

Sample ID: AUBURN WETLAND

ACZ Sample ID: ***L74897-01***
Date Sampled: *10/05/21 12:25*
Date Received: *07/27/22*
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		38.4			t CaCO3/Kt	0.31	3.1	09/20/22 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		0.0			t CaCO3/Kt	1	5	09/20/22 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		-38.4			t CaCO3/Kt			09/20/22 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1	<0.1	U	*	%	0.1	0.5	08/11/22 11:21	mep
Solids, Percent	D2216-80	1	85.0	H	*	%	0.1	0.5	08/03/22 20:15	scm
Sulfur Forms	M600/2-78-054 3.2.4									
Sulfur Organic Residual		1	0.98			%	0.01	0.1	08/12/22 0:00	jpb
Sulfur Pyritic Sulfide		1	<0.01	U	*	%	0.01	0.1	08/12/22 0:00	jpb
Sulfur Sulfate		1	0.27			%	0.01	0.1	08/12/22 0:00	jpb
Sulfur Total		1	1.23		*	%	0.01	0.1	08/12/22 0:00	jpb
Total Sulfur minus Sulfate		1	0.96			%	0.01	0.1	08/12/22 0:00	jpb

ACZ LABORATORIES | Accredited Environmental Testing | 2773 Downhill Drive Steamboat Springs, CO 80487 (970) 879-6590 | L74897

CHAIN of CUSTODY

Report to:

Name: Tanner Banks	Address: 17 N Uncompahgre Ave, STE B Montrose, CO 81401
Company: Trout Unlimited	
E-mail: tanner.banks@tu.org	Telephone: 970.390.9492

Copy of Report to:

Name:	E-mail:
Company:	Telephone:

Invoice to:

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

Copy of Invoice to:

Name:	Address:
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 [X] 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: Jeff Litteral, Tanner Banks Sampler's Site Information State CO Zip code 81401 Time Zone MST

*Sampler's 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 — ANALYSES REQUESTED (attach list or use quote number)

Quote #:

PO#:

Reporting state for compliance testing:

Check box if samples include NRC licensed material? [ ]

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	Total Metals	SPLP						
Auburn Wetland	10/5/2021 12:25 pm		1	✓	✓						
Lower Irene WP-2 Middle	6/13/22 : 1300		↓	↓	↓						
Lower Irene WP-1 Lower	6/13/22 : 1300		↓	↓	↓						

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

REMARKS

See Trout Unlimited - AML Quote

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

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Tanner Banks	7/26/22 : 1314	[illegible]	8/2/22 1415

Qualtrax ID: 1984 Revision #: 2 White - Return with sample. Yellow - Retain for your records.

L74897 Chain of Custody

ACZ Laboratories, Inc.

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

Inorganic Analytical Results

Trout Unlimited Inc
Project ID:
Sample ID: TRONOX IRON CITY 30PT WASTE ROCK PILE

ACZ Sample ID: ***L67564-02***
Date Sampled: *07/30/21 11:00*
Date Received: *08/04/21*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP								08/12/21 13:41	kja
Total Hot Plate Digestion (1312)	M3010A ICP								10/27/21 11:15	kja

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum (1312)	M6010D ICP	1	1.32		*	mg/L	0.05	0.25	10/28/21 18:12	kja
Aluminum (TCLP)	M6010D ICP	1	0.135	B	*	mg/L	0.05	0.25	08/13/21 13:17	jlw
Aluminum, total (3050)	M6010D ICP	101	17800		*	mg/Kg	5.05	25.3	08/18/21 14:15	jlw
Arsenic (1312)	M6010D ICP	1	0.077	B	*	mg/L	0.04	0.2	10/28/21 18:12	kja
Arsenic (TCLP)	M6010D ICP	1	<0.04	U	*	mg/L	0.04	0.2	08/13/21 13:17	jlw
Arsenic, total (3050)	M6010D ICP	505	1480			mg/Kg	20.2	101	08/19/21 19:11	jlw
Cadmium (1312)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.025	10/28/21 18:12	kja
Cadmium (TCLP)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.025	08/13/21 13:17	jlw
Cadmium, total (3050)	M6010D ICP	101	<0.808	U	*	mg/Kg	0.808	2.53	08/18/21 14:15	jlw
Chromium (1312)	M6010D ICP	1	<0.02	U	*	mg/L	0.02	0.05	10/28/21 18:12	kja
Chromium (TCLP)	M6010D ICP	1	<0.02	U	*	mg/L	0.02	0.05	08/13/21 13:17	jlw
Chromium, total (3050)	M6010D ICP	101	3.00	B		mg/Kg	2.02	5.05	08/18/21 14:15	jlw
Copper (1312)	M6010D ICP	1	2.35		*	mg/L	0.01	0.05	10/28/21 18:12	kja
Copper (TCLP)	M6010D ICP	1	0.968			mg/L	0.01	0.05	08/13/21 13:17	jlw
Copper, total (3050)	M6010D ICP	505	3280			mg/Kg	5.05	25.3	08/19/21 19:11	jlw
Iron (1312)	M6010D ICP	1	8.09		*	mg/L	0.06	0.15	10/28/21 18:12	kja
Iron (TCLP)	M6010D ICP	1	0.217		*	mg/L	0.06	0.15	08/13/21 13:17	jlw
Iron, total (3050)	M6010D ICP	101	19300		*	mg/Kg	6.06	15.2	08/18/21 14:15	jlw
Lead (1312)	M6010D ICP	1	4.14		*	mg/L	0.03	0.15	10/28/21 18:12	kja
Lead (TCLP)	M6010D ICP	1	6.04		*	mg/L	0.03	0.15	08/13/21 13:17	jlw
Lead, total (3050)	M6010D ICP	101	1360		*	mg/Kg	3.03	15.2	08/18/21 14:15	jlw
Manganese (1312)	M6010D ICP	1	0.052		*	mg/L	0.01	0.05	10/28/21 18:12	kja
Manganese (TCLP)	M6010D ICP	1	0.028	B	*	mg/L	0.01	0.05	08/13/21 13:17	jlw
Manganese, total (3050)	M6010D ICP	101	244		*	mg/Kg	1.01	5.05	08/18/21 14:15	jlw
Nickel (1312)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.04	10/28/21 18:12	kja
Nickel (TCLP)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.04	08/13/21 13:17	jlw
Nickel, total (3050)	M6010D ICP	101	1.26	B		mg/Kg	0.808	4.04	08/18/21 14:15	jlw
Selenium (1312)	M6010D ICP	1	<0.05	U	*	mg/L	0.05	0.25	10/28/21 18:12	kja
Selenium (TCLP)	M6010D ICP	1	<0.05	U	*	mg/L	0.05	0.25	08/13/21 13:17	jlw
Selenium, total (3050)	M6010D ICP	101	5.62	B		mg/Kg	5.05	25.3	08/18/21 14:15	jlw

Silver (1312)	M6010D ICP	1	<0.01	U	*	mg/L	0.01	0.025	10/28/21 18:12	kja
			<0.01	U					08/13/21 13:17	
			28.1						08/18/21 14:15	
			0.187						10/28/21 18:12	
			0.118						08/13/21 13:17	
			292						08/18/21 14:15	

ACZ Laboratories, Inc.

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

Inorganic Analytical Results

Trout Unlimited Inc

Project ID:

Sample ID: TRONOX IRON CITY 30PT WASTE ROCK PILE

ACZ Sample ID: ***L67564-02***
Date Sampled: *07/30/21 11:00*
Date Received: *08/04/21*
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		40.6			t CaCO3/Kt	0.31	3.1	11/09/21 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		0.0			t CaCO3/Kt	1	5	11/09/21 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		-40.6			t CaCO3/Kt			11/09/21 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1	<0.1	U	*	%	0.1	0.5	10/01/21 11:45	jpb
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	250		*	um			10/07/21 0:00	zln
pH		1	3.9		*	units	0.1	0.1	10/07/21 0:00	zln
Solids, Percent	D2216-80	1	87.6		*	%	0.1	0.5	08/06/21 3:36	jpb
Sulfur Forms	M600/2-78-054 3.2.4									
Sulfur Organic Residual		1	0.58			%	0.01	0.1	10/01/21 0:00	jpb
Sulfur Pyritic Sulfide		1	0.43		*	%	0.01	0.1	10/01/21 0:00	jpb
Sulfur Sulfate		1	0.29			%	0.01	0.1	10/01/21 0:00	jpb
Sulfur Total		1	1.30		*	%	0.01	0.1	10/01/21 0:00	jpb
Total Sulfur minus Sulfate		1	1.01			%	0.01	0.1	10/01/21 0:00	jpb

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								08/05/21 15:10	jpb
Crush and Pulverize (Ring & Puck)	EPA-600/2-78-054 3.1.3								08/13/21 11:20	zln
Digestion - Hot Plate	M3050B ICP								08/17/21 13:46	mep
Saturated Paste Extraction	USDA No. 60 (2)								10/06/21 16:48	zln
Synthetic Precip. Leaching Procedure	M1312								10/25/21 19:07	zln
TCLP Metal Extraction	M1311								08/10/21 5:52	ksf

ACZ Laboratories, Inc.

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Inorganic Analytical Results

Trout Unlimited Inc

Project ID:

Sample ID: TRONOX IRON CITY 30PT DISPERSED MATERIAL

ACZ Sample ID: ***L67564-03***
Date Sampled: *07/30/21 11:15*
Date Received: *08/04/21*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP								08/12/21 15:08	kja
Total Hot Plate Digestion (1312)	M3010A ICP								10/27/21 11:38	kja

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum (1312)	M6010D ICP	1	0.053	B	*	mg/L	0.05	0.25	10/28/21 18:16	kja
Aluminum (TCLP)	M6010D ICP	1	0.100	B	*	mg/L	0.05	0.25	08/13/21 13:25	jlw
Aluminum, total (3050)	M6010D ICP	101	15900		*	mg/Kg	5.05	25.3	08/18/21 14:19	jlw
Arsenic (1312)	M6010D ICP	1	<0.04	U	*	mg/L	0.04	0.2	10/28/21 18:16	kja
Arsenic (TCLP)	M6010D ICP	1	<0.04	U	*	mg/L	0.04	0.2	08/13/21 13:25	jlw
Arsenic, total (3050)	M6010D ICP	101	320			mg/Kg	4.04	20.2	08/18/21 14:19	jlw
Cadmium (1312)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.025	10/28/21 18:16	kja
Cadmium (TCLP)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.025	08/13/21 13:25	jlw
Cadmium, total (3050)	M6010D ICP	101	<0.808	U	*	mg/Kg	0.808	2.53	08/18/21 14:19	jlw
Chromium (1312)	M6010D ICP	1	<0.02	U	*	mg/L	0.02	0.05	10/28/21 18:16	kja
Chromium (TCLP)	M6010D ICP	1	<0.02	U	*	mg/L	0.02	0.05	08/13/21 13:25	jlw
Chromium, total (3050)	M6010D ICP	101	4.71	B		mg/Kg	2.02	5.05	08/18/21 14:19	jlw
Copper (1312)	M6010D ICP	1	0.042	B	*	mg/L	0.01	0.05	10/28/21 18:16	kja
Copper (TCLP)	M6010D ICP	1	0.016	B		mg/L	0.01	0.05	08/13/21 13:25	jlw
Copper, total (3050)	M6010D ICP	101	116			mg/Kg	1.01	5.05	08/18/21 14:19	jlw
Iron (1312)	M6010D ICP	1	<0.06	U	*	mg/L	0.06	0.15	10/28/21 18:16	kja
Iron (TCLP)	M6010D ICP	1	0.127	B	*	mg/L	0.06	0.15	08/13/21 13:25	jlw
Iron, total (3050)	M6010D ICP	101	44900		*	mg/Kg	6.06	15.2	08/18/21 14:19	jlw
Lead (1312)	M6010D ICP	1	<0.03	U	*	mg/L	0.03	0.15	10/28/21 18:16	kja
Lead (TCLP)	M6010D ICP	1	<0.03	U	*	mg/L	0.03	0.15	08/13/21 13:25	jlw
Lead, total (3050)	M6010D ICP	101	234		*	mg/Kg	3.03	15.2	08/18/21 14:19	jlw
Manganese (1312)	M6010D ICP	1	0.027	B	*	mg/L	0.01	0.05	10/28/21 18:16	kja
Manganese (TCLP)	M6010D ICP	1	0.042	B	*	mg/L	0.01	0.05	08/13/21 13:25	jlw
Manganese, total (3050)	M6010D ICP	101	203		*	mg/Kg	1.01	5.05	08/18/21 14:19	jlw
Nickel (1312)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.04	10/28/21 18:16	kja
Nickel (TCLP)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.04	08/13/21 13:25	jlw
Nickel, total (3050)	M6010D ICP	101	1.24	B		mg/Kg	0.808	4.04	08/18/21 14:19	jlw
Selenium (1312)	M6010D ICP	1	<0.05	U	*	mg/L	0.05	0.25	10/28/21 18:16	kja
Selenium (TCLP)	M6010D ICP	1	<0.05	U	*	mg/L	0.05	0.25	08/13/21 13:25	jlw
Selenium, total (3050)	M6010D ICP	101	<5.05	U		mg/Kg	5.05	25.3	08/18/21 14:19	jlw
Silver (1312)	M6010D ICP	1	<0.01	U	*	mg/L	0.01	0.025	10/28/21 18:16	kja

<0.01	U	08/13/21 13:25
<1.01	U	08/18/21 14:19
<0.02	U	10/28/21 18:16
<0.02	U	08/13/21 13:25
33.0		08/18/21 14:19

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

Inorganic Analytical Results

Trout Unlimited Inc
Project ID:
Sample ID: TRONOX IRON CITY 30PT DISPERSED MATERIAL

ACZ Sample ID: ***L67564-03***
Date Sampled: *07/30/21 11:15*
Date Received: *08/04/21*
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		10.3			t CaCO3/Kt	0.31	3.1	11/09/21 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		0.0			t CaCO3/Kt	1	5	11/09/21 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		-10.3			t CaCO3/Kt			11/09/21 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1	<0.1	U	*	%	0.1	0.5	10/01/21 12:10	jpb
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	250		*	um			10/07/21 0:00	zln
pH		1	4.2		*	units	0.1	0.1	10/07/21 0:00	zln
Solids, Percent	D2216-80	1	85.1		*	%	0.1	0.5	08/06/21 7:48	jpb
Sulfur Forms	M600/2-78-054 3.2.4									
Sulfur Organic Residual		1	0.17			%	0.01	0.1	10/01/21 0:00	jpb
Sulfur Pyritic Sulfide		1	0.02	B	*	%	0.01	0.1	10/01/21 0:00	jpb
Sulfur Sulfate		1	0.14			%	0.01	0.1	10/01/21 0:00	jpb
Sulfur Total		1	0.33		*	%	0.01	0.1	10/01/21 0:00	jpb
Total Sulfur minus Sulfate		1	0.19			%	0.01	0.1	10/01/21 0:00	jpb

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								08/05/21 15:20	jpb
Crush and Pulverize (Ring & Puck)	EPA-600/2-78-054 3.1.3								08/13/21 11:40	zln
Digestion - Hot Plate	M3050B ICP								08/17/21 14:22	mep
Saturated Paste Extraction	USDA No. 60 (2)								10/06/21 16:52	zln
Synthetic Precip. Leaching Procedure	M1312								10/25/21 20:15	zln
TCLP Metal Extraction	M1311								08/10/21 12:27	ksf

ACZ Laboratories, Inc.

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

Inorganic Analytical Results

Trout Unlimited Inc

Project ID:

Sample ID: TRONOX IRON CITY SMALL DUMP 30PT

ACZ Sample ID: ***L67564-04***
Date Sampled: *07/30/21 12:00*
Date Received: *08/04/21*
Sample Matrix: *Soil*

Inorganic Prep

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010A ICP								08/12/21 15:52	kja
Total Hot Plate Digestion (1312)	M3010A ICP								10/27/21 12:01	kja

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Aluminum (1312)	M6010D ICP	1	0.527		*	mg/L	0.05	0.25	10/28/21 18:20	kja
Aluminum (TCLP)	M6010D ICP	1	0.082	B	*	mg/L	0.05	0.25	08/13/21 13:33	jlw
Aluminum, total (3050)	M6010D ICP	101	4430		*	mg/Kg	5.05	25.3	08/18/21 14:22	jlw
Arsenic (1312)	M6010D ICP	1	0.155	B	*	mg/L	0.04	0.2	10/28/21 18:20	kja
Arsenic (TCLP)	M6010D ICP	1	0.196	B	*	mg/L	0.04	0.2	08/13/21 13:33	jlw
Arsenic, total (3050)	M6010D ICP	1010	4880			mg/Kg	40.4	202	08/19/21 19:15	jlw
Cadmium (1312)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.025	10/28/21 18:20	kja
Cadmium (TCLP)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.025	08/13/21 13:33	jlw
Cadmium, total (3050)	M6010D ICP	101	1.17	B	*	mg/Kg	0.808	2.53	08/18/21 14:22	jlw
Chromium (1312)	M6010D ICP	1	<0.02	U	*	mg/L	0.02	0.05	10/28/21 18:20	kja
Chromium (TCLP)	M6010D ICP	1	<0.02	U	*	mg/L	0.02	0.05	08/13/21 13:33	jlw
Chromium, total (3050)	M6010D ICP	101	<2.02	U		mg/Kg	2.02	5.05	08/18/21 14:22	jlw
Copper (1312)	M6010D ICP	1	2.16		*	mg/L	0.01	0.05	10/28/21 18:20	kja
Copper (TCLP)	M6010D ICP	1	1.42			mg/L	0.01	0.05	08/13/21 13:33	jlw
Copper, total (3050)	M6010D ICP	1010	6060			mg/Kg	10.1	50.5	08/19/21 19:15	jlw
Iron (1312)	M6010D ICP	1	8.76		*	mg/L	0.06	0.15	10/28/21 18:20	kja
Iron (TCLP)	M6010D ICP	1	0.211		*	mg/L	0.06	0.15	08/13/21 13:33	jlw
Iron, total (3050)	M6010D ICP	1010	55300		*	mg/Kg	60.6	152	08/19/21 19:15	jlw
Lead (1312)	M6010D ICP	1	5.78		*	mg/L	0.03	0.15	10/28/21 18:20	kja
Lead (TCLP)	M6010D ICP	1	1.98		*	mg/L	0.03	0.15	08/13/21 13:33	jlw
Lead, total (3050)	M6010D ICP	101	4120		*	mg/Kg	3.03	15.2	08/18/21 14:22	jlw
Manganese (1312)	M6010D ICP	1	0.016	B	*	mg/L	0.01	0.05	10/28/21 18:20	kja
Manganese (TCLP)	M6010D ICP	1	<0.01	U	*	mg/L	0.01	0.05	08/13/21 13:33	jlw
Manganese, total (3050)	M6010D ICP	101	7.06		*	mg/Kg	1.01	5.05	08/18/21 14:22	jlw
Nickel (1312)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.04	10/28/21 18:20	kja
Nickel (TCLP)	M6010D ICP	1	<0.008	U	*	mg/L	0.008	0.04	08/13/21 13:33	jlw
Nickel, total (3050)	M6010D ICP	101	0.970	B		mg/Kg	0.808	4.04	08/18/21 14:22	jlw
Selenium (1312)	M6010D ICP	1	<0.05	U	*	mg/L	0.05	0.25	10/28/21 18:20	kja
Selenium (TCLP)	M6010D ICP	1	<0.05	U	*	mg/L	0.05	0.25	08/13/21 13:33	jlw
Selenium, total (3050)	M6010D ICP	101	18.2	B		mg/Kg	5.05	25.3	08/18/21 14:22	jlw

Silver (1312)	M6010D ICP	1	<0.01	U	*	mg/L	0.01	0.025	10/28/21 18:20	kja
			<0.01	U					08/13/21 13:33	
			81.9						08/18/21 14:22	
			0.044	B					10/28/21 18:20	
			0.023	B					08/13/21 13:33	
			129						08/18/21 14:22	

ACZ Laboratories, Inc.

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

Inorganic Analytical Results

Trout Unlimited Inc

Project ID:

Sample ID: TRONOX IRON CITY SMALL DUMP 30PT

ACZ Sample ID: ***L67564-04***
Date Sampled: *07/30/21 12:00*
Date Received: *08/04/21*
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		175			t CaCO3/Kt	0.31	3.1	11/09/21 0:00	calc
Acid Neutralization Potential (calc)	M600/2-78-054 1.3		0.0			t CaCO3/Kt	1	5	11/09/21 0:00	calc
Acid-Base Potential (calc on Sulfur total)	M600/2-78-054 1.3		-175			t CaCO3/Kt			11/09/21 0:00	calc
Neutralization Potential as CaCO3	M600/2-78-054 3.2.3	1	<0.1	U	*	%	0.1	0.5	10/01/21 12:35	jpb
pH, Saturated Paste	EPA 600/2-78-054 section 3.2.2									
Max Particle Size		1	250		*	um			10/07/21 0:00	zln
pH		1	3.9		*	units	0.1	0.1	10/07/21 0:00	zln
Solids, Percent	D2216-80	1	87.8		*	%	0.1	0.5	08/06/21 12:00	jpb
Sulfur Forms	M600/2-78-054 3.2.4									
Sulfur Organic Residual		1	1.87			%	0.01	0.1	10/01/21 0:00	jpb
Sulfur Pyritic Sulfide		1	3.54		*	%	0.01	0.1	10/01/21 0:00	jpb
Sulfur Sulfate		1	0.18			%	0.01	0.1	10/01/21 0:00	jpb
Sulfur Total		1	5.59		*	%	0.01	0.1	10/01/21 0:00	jpb
Total Sulfur minus Sulfate		1	5.41			%	0.01	0.1	10/01/21 0:00	jpb

Soil Preparation

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Air Dry at 34 Degrees C	USDA No. 1, 1972								08/05/21 15:30	jpb
Crush and Pulverize (Ring & Puck)	EPA-600/2-78-054 3.1.3								08/13/21 12:00	zln
Digestion - Hot Plate	M3050B ICP								08/17/21 14:58	mep
Saturated Paste Extraction	USDA No. 60 (2)								10/06/21 16:56	zln
Synthetic Precip. Leaching Procedure	M1312								10/25/21 21:24	zln
TCLP Metal Extraction	M1311								08/10/21 15:45	ksf

ACZ LABORATORIES | Accredited Environmental Testing | 2773 Downhill Drive, Steamboat Springs, CO 80487, (970) 879-6590 | L67564

CHAIN of CUSTODY

Report to:

Name: Tanner Banks	Address: 1103 S 3rd St
Company: Trout Unlimited	Montrose, CO 81401
E-mail: tanner.banks@tu.org	Telephone: 970.390.9492

Copy of Report to:

Name:	E-mail:
Company:	Telephone:

Invoice to:

Name: Tanner Banks	Address: 1777 N. Kent St. STE 1000
Company: Trout Unlimited	Arlington, VA 22209
E-mail: tanner.banks@tu.org	Telephone: 970.390.9492

Copy of Invoice to:

Name:	Address:
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 [X]

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: Tanner Banks **Sampler's Site Information** **State** CO **Zip code** 81401 **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 — ANALYSES REQUESTED *(attach list or use quote number)*

Quote #: Tronox : Ironton
PO#:
Reporting state for compliance testing: Colorado
Check box if samples include NRC licensed material? X

	SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	total metals	TCLP						
1	Tronox · Silver Bell Dispersed · 30 pt	7/30/21 :10am		1	↓	↓						
2	Tronox · Iron City 30pt · Waste Rockpile	7/30/21 : 11 AM			↓	↓						
3	Tronox · Iron City 30pt · Dispersed Material	7/30/21 11:15 AM			↓	↓						
4	Tronox · Iron City Small Dump · 30pt	7/30/21 12:00 AM			↓	↓						

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

REMARKS

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

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Tann		[signature]	8/4/21 1056

Qualtrax ID: 1984 Revision #: 2 White - Return with sample. Yellow - Retain for your records.

L67564 Chain of Custod